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Office of The Ombudsman, Hong Kong



主動調查報告
Direct Investigation Report

食物環境衞生署執行防蚊及滅蚊工作成效
Effectiveness of Mosquito Prevention and Control by Food and Environmental Hygiene Department

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Executive Summary
Direct Investigation Report

Effectiveness of Mosquito Prevention and Control by
Food and Environmental Hygiene Department

Introduction

The mosquito problem is a public concern. Mosquito infestation would not only be a nuisance to daily life, but also spread deadly diseases such as dengue fever and Japanese encephalitis.

2. The Pest Control Advisory Section and District Environmental Hygiene Offices' ("DEHOs") Pest Control Sections under the Food and Environmental Hygiene Department ("FEHD") are responsible for mosquito prevention and control in public places all over Hong Kong. FEHD also closely liaises with other Government departments and organisations, and provides them with technical support and training to assist in anti-mosquito work at venues and premises under the latter's management.

3. There are public views that FEHD's selected locations for setting up gravidtraps (formerly ovitraps) are incomprehensive, thereby producing inaccurate survey results. The time lag in FEHD's release of surveillance indices makes it difficult for the public to stay on top of the latest situation. Moreover, the relatively high indices recorded in some districts in certain months as reported by the media indicated serious mosquito infestation in those districts. There are also media reports about FEHD's improper management over the Pest Control Sections leading to ineffective mosquito prevention and control.

Our Findings

4. FEHD plays a leading role in anti-mosquito work. Its duties are multi-faceted, including surveillance of *Aedes albopictus* (generally known as "Asian Tiger Mosquito") infestation and initiating strategic actions in response to surveillance data, taking preventive and control measures, handling public complaints about mosquito nuisance, and managing the Pest Control Teams ("PCTs") under the Pest Control Sections. After examining FEHD's anti-mosquito work, we have identified the following areas for improvement.

Dengue Vector Surveillance Programme

5. FEHD's key objective is to prevent and control the transmission of diseases by mosquito vectors. Since 2003, FEHD has operated the Dengue Vector Surveillance Programme ("DVS Programme") by setting up ovitraps/gravidtraps territory-wide to monitor the prevalence of *Aedes albopictus*, a species with extensive distribution and higher risk of transmitting dengue. As at April 2021, a total of 3,440 gravidtraps were placed in 64 selected survey areas throughout the 19 administrative districts in Hong Kong.

Analysis and release of information

6. Our investigation reveals that FEHD releases monthly the Gravidtrap Index and Density Index of all survey areas by means of table and graphic map. The Gravidtrap Index enumerates the percentage of gravidtraps with the presence of *Aedes albopictus* (referred to as "*Aedes*-positive gravidtraps"), thereby evaluating whether the species is extensively distributed within a survey area. The Density Index represents the average number of *Aedes albopictus* mosquitoes collected by each *Aedes*-positive gravidtrap for quantifying their level of activity.

7. FEHD has classified the Gravidtrap Index into different levels and provided a descriptor for each level. When the index surges to the alert levels, i.e. Levels 3 and 4, FEHD should alert the public. However, FEHD only provides the index monthly in actual figures without mentioning their respective levels and implications.

8. As the Gravidtrap Index is classified into different levels, FEHD should have announced the index and its corresponding level. Based on the descriptor for each level, the public can better understand the severity of mosquito infestation in different survey areas and the proper anti-mosquito measures to be taken. When the index surges to the alert levels, FEHD should also highlight such survey areas of special concern for better warning effect. Moreover, the public might be uncertain about the coverage of the 64 survey areas. FEHD should delineate each area's boundaries and release data, including the index and its level, with the assistance of diagrams and interactive maps to make all critical information clear at a glance.

9. In its monthly release, FEHD would highlight the Monthly Ovitrap/Gravidtrap Index ("MOI/MGI")[Note] to explain to the public whether the threats posed by *Aedes albopictus* were serious. The MOIs/MGIs over multiple years are compared to reveal the trends. The MOI/MGI, obtained by aggregating data from all survey areas, can theoretically reflect the territory-wide breeding of *Aedes albopictus* in that month. Nevertheless, there are as many as 64 survey areas. Even within the same month, the indices in different areas may vary substantially. Taking the data from 2016 to 2020 as an example, despite no significant fluctuation of the MOIs/MGIs during this period, there was a rising trend in the number and frequency of survey areas recording indices at Level 3 to Level 4 each month.

10. As such, the MOI/MGI is too broad-brush in reflecting the extensiveness of *Aedes albopictus* in Hong Kong. The more infested areas are often averaged out by those less infested ones causing the public to under-estimate mosquito infestation. Insofar as realistically revealing the overall condition of mosquito infestation of a particular month is concerned, and for the purpose of yearly and multi-year comparisons, the MOI/MGI is seemingly too general without in-depth analysis.

11. Therefore, FEHD should review how to optimise the use of data from the DVS Programme, such as conducting a thorough trend analysis of the number of survey areas recording different levels of the monthly Gravidtrap Index, especially Levels 3 and 4. This is to ensure that the results obtained can more accurately reflect the actual condition of mosquito infestation in Hong Kong, and to enhance the breadth and depth of such analysis.

<u>Launch of Density Index</u>

12. In April 2020, FEHD launched the Density Index, which directly corelates with the Gravidtrap Index in reflecting mosquito infestation. For instance, when both indices are at high levels, it shows that *Aedes albopictus* is extensively distributed in the survey area, and its quantity is also high. When the Gravidtrap Index is low but the Density Index is relatively high, it means that *Aedes albopictus* is not extensively distributed but is relatively active in the vicinity of specific gravidtraps.

13. FEHD has introduced the Density Index with good intention as it allows another perspective for the public to understand the infestation of *Aedes albopictus* in Hong

[Note] MOI/MGI is the percentage of *Aedes*-positive ovitraps/gravidtraps against the total number of traps retrieved monthly from all survey areas.

Kong. However, the Density Index has been launched and released monthly without proper explanations to facilitate the public's comprehension of its objective, concept and correlation with the Gravidtrap Index. In such circumstances, the public might easily confound the two indices, possibly undermining the Density Index as an indicator of the activity level of *Aedes albopictus*.

14. As the Density Index has already been introduced, FEHD should avoid causing misunderstanding by specifying that the Density Index now in force is for reference only. Meanwhile, FEHD should promptly classify the Density Index into different levels with a descriptor provided for each level, and make sure that the surveillance data released is more explicit, uniform and comprehensible.

<u>Response mechanism</u>

15. Where a survey area records a monthly Gravidtrap Index at alarm levels (i.e. Level 3 or 4), FEHD would activate the response mechanism to convene district anti-mosquito task force meetings with Government departments and organisations, property management agents and private venues in the area concerned. The management offices of residential premises, schools, construction sites and public utilities affected would also be notified.

16. FEHD is mainly responsible for the anti-mosquito work in public places. Hence, when more serious mosquito infestation is detected in certain survey areas, FEHD needs to promptly collaborate with other departments and parties managing venues and premises in those areas to bring the index down to the target level rapidly. We consider FEHD to have acted positively and commendably in establishing the response mechanism, which would not only expedite communication and liaison, but also create synergy for the overall anti-mosquito work.

17. We note that FEHD did mention the response mechanism in its press releases but mainly in the months when the mechanism was activated, and that its details were lacking. FEHD had not publicly promoted and disseminated details of the response mechanism through other channels as well.

18. Anti-mosquito work is not just the purview of FEHD. It is crucial for other relevant departments, stakeholders and members of the public to do their part to achieve satisfactory results. Moreover, the purpose of establishing the response mechanism is mainly for stepping up communication and liaison amongst stakeholders to enhance the effectiveness of anti-mosquito work. If the public are well informed of the

mechanism's details, they can assist FEHD in monitoring and facilitating its actual operation. Besides, if serious mosquito infestation persists in a survey area even after activation of the response mechanism, the public can report the situation direct to the relevant departments or management authorities for follow-up action. We urge FEHD to strengthen publicity of the response mechanism with its details more widely disseminated for greater public awareness and participation, thereby enhancing the effectiveness of anti-mosquito work.

Anti-mosquito Work

19. In addition to the territory-wide surveillance of *Aedes albopictus*, FEHD also conducts surveillance of *Culex tritaeniorhynchus* (vector of Japanese encephalitis) and *Anopheles* (vector of malaria), which are less extensive and pose a lower risk of disease transmission, at selected locations. Its surveillance includes collecting samples of adult mosquitoes for laboratory tests to assess the risk of disease transmission.

20. Whether territory-wide surveillance of all mosquito vectors is necessary and which surveillance methodologies are proper for different species are matters relating to FEHD's professional judgement based on its knowledge of various mosquito species and assessment of their risks. These matters are not subject to our comment. Nevertheless, since FEHD has adopted the current surveillance models for years, it is worth reviewing whether they are still entirely applicable to the present environment and situation. FEHD should devise a mechanism for regularly reviewing its methodologies, including any need to step up surveillance efforts, change or adjust the surveillance process, and include more species in its surveillance. In conducting the review, FEHD may consider inviting local academic institutes to participate in joint research for obtaining expert advice from different sectors. The research results can be used to improve FEHD's strategies and implementation of anti-mosquito work.

21. Meanwhile, FEHD has a duty to initiate different levels of control actions as specified in its Pest Control Technical Circular (Mosquito) No. 3 ("Technical Circular") in accordance with the levels of Ovitrap/Gravidtrap Index recorded for a particular survey area. Thus, we have selected a random sample of four survey areas with an index at alert levels, namely Pok Fu Lam (37.9% in June 2018), Yau Tong (45.1% in July 2018), Wong Tai Sin Central (30.4% in June 2019) and Ma On Shan (42.2% in June 2019) and requested FEHD to provide the relevant pest control records for our scrutiny.

22. After scrutiny, we confirm that targeted control actions were initiated by FEHD within the 100-metre radius of *Aedes*-positive ovitraps, including application of larvicidal oils and larvicides at breeding sites, removal of stagnant water and fogging operations with adulticides. The DEHOs of certain survey areas also sought support from other sections for more manpower to handle the control work, conducted joint inspections with relevant departments and provided them with technical advice. Nonetheless, some of FEHD's records were only about the daily routines for mosquito prevention and control in those survey areas, with no indication of control actions taken according to the Technical Circular. FEHD should give proper instructions requiring its staff to clearly record the anti-mosquito actions taken according to the Technical Circular for enhancing internal supervision and monitoring the effectiveness of control actions.

Use of Mosquito-related Complaint Data

23. FEHD's major target is controlling mosquito vectors because those species pose a serious threat to public health. As regards the nuisance caused by mosquitoes, FEHD tackles it concurrently with its control of mosquito vectors and handling of public complaints about mosquito infestation. FEHD's information shows that it has in place a mechanism for handling mosquito-related complaints, under which FEHD staff are required to contact the complainants to obtain further details, conduct investigations and perform anti-mosquito work. FEHD also maintains the monthly and annual statistics on mosquito-related complaints received territory-wide and in each district.

24. Regarding the collation and analysis of mosquito-related complaint data, as well as the trends of caseload and districts subjected to more serious infestation, FEHD explained that mosquito-related complaints are affected by many factors, including weather, environment and public concern about the mosquito problem. Given the differences in geographical location and demographic features of each district, the complaint data cannot entirely reflect the condition of mosquito infestation in a particular district. As an example, FEHD cited public concerns about the mosquito problem as one of the factors, stating that a spike in mosquito-related complaints during 2016 and 2018 coincided with cases of Zika virus infections and an outbreak of dengue fever in Hong Kong. Nevertheless, FEHD gave no further analysis and explanation on the trends of mosquito-related complaints in the past.

25. We acknowledge FEHD's rationale for according lower priority to the handling of mosquito nuisance. As a matter of fact, most of the mosquito species found in Hong Kong are non-vectors causing only a nuisance with no serious threats to public health.

FEHD also carries out investigations and anti-mosquito work in response to public complaints. However, FEHD has not thoroughly collated and analysed the complaint data, nor has it initiated strategic anti-mosquito measures in districts where mosquito nuisance is more serious. The FEHD cannot adequately address public concerns about the mosquito problem, nor can it meet public expectations for the authorities' preventive and control work.

26. For the general public, the nuisance caused by different mosquito species is indistinguishable. As long as they suffer from frequent mosquito stings in everyday life, they will perceive mosquito infestation as serious. The surveillance data released by FEHD might strike them as falling short of their perception. Hence, FEHD should allocate resources for collation and analysis of mosquito-related complaints to gauge public concerns and identify the districts and locations subjected to higher risk of mosquito infestation, so that it can respond by deploying the manpower and resources of PCTs in a more systematic and efficient manner. In the long run, FEHD should explore the feasibility of incorporating the mosquito-related complaints into its mosquito surveillance data, so as to reflect more comprehensively the actual condition of mosquito infestation in various districts.

Supervision of PCTs

27. The duties of pest control, including mosquito control, in public places throughout the territory are performed by FEHD's PCTs (comprising in-house and contractor staff) under DEHOs' Pest Control Sections. Some of PCTs' in-house staff are foremen tasked with routine inspections and surprise checks on contractor staff. The remaining in-house staff are divided into 93 teams, each comprising 4 to 11 members, including Workmen II led by a Foreman or Ganger. They are deployed to 19 administrative districts in Hong Kong to perform mosquito prevention and control duties. The contractor staff of 2,178 are all responsible for mosquito prevention and control, with 48 to 192 members in each district.

28. FEHD supervises the performance of PCTs according to its Operational Manual for Pest Control Services (applicable to both in-house staff and contractors) and Operational Manual for Management of Pest Control Contracts (applicable to contractors only) (referred to as "OMs"). The OMs require FEHD to conduct routine field inspections and surprise checks on the service of contractors. Surprise checks on FEHD's in-house teams is also stipulated under the relevant OM.

29. Upon scrutinising the inspection records of three survey areas (namely Wong Tai Sin Central, Tuen Mun West and Ma On Shan), we notice inadequacies in both the routine and surprise inspections on contractors' teams conducted by FEHD's inspection officers of different ranks. After verification, FEHD explained that they were caused by certain officers' failure to carry out inspections as required, or to input the records on the Contract Management Computer System after completing the inspections. FEHD has given due advice to the relevant officers. We have to point out that our selection of only a few survey areas for scrutiny has already revealed incomplete/irregular inspection records or insufficient number of inspecting involving officers of different ranks. This reflects not only inadequacies on the part of inspecting officers in discharging their duties, but also the lack of proper supervision over the inspection work by senior management. FEHD should, therefore, consider establishing a mechanism for periodically reviewing whether the inspection requirements under the OMs have been fully complied with, so as to ensure effective monitoring by way of inspection as expected.

30. Within the regime of PCTs, the scope of duties discharged by FEHD's in-house staff and contractors is more or less the same. Adequate supervision over both groups is crucial to ensure proper deployment of manpower. However, we notice that although inspections of FEHD's in-house staff are conducted, they are only subject to surprise checks in every two months and four months. The frequency is too low and worth a review.

31. It has also come to our attention that some requirements for inspection frequency under the two OMs are inconsistent. Taking the inspection by foremen on the contractors as an example, the OM for Pest Control Services stipulates the frequency on a monthly basis, while the OM for Management of Pest Control Contracts provides it on a daily or weekly basis. The wordings could lead to misunderstanding. Noting the inconsistencies, FEHD undertook to review the OMs and make necessary amendments.

32. Based on the analysis in **paragraphs 28 to 31**, FEHD should comprehensively scrutinise and review the OMs (including introducing a mechanism to ensure compliance with the inspection requirements, reviewing the frequency of inspections on its in-house teams, and amending those inconsistent paragraphs on inspection frequencies), with a view to enhancing the effectiveness in supervising the PCTs.

Recommendations

33. We recommend that FEHD:

DVS Programme

(1) appropriately consolidate the data released monthly under the DVS Programme to make important information clear for better warning effect;

(2) review how to optimise the use of the DVS Programme data for more detailed trend analyses so as to depict the actual condition of mosquito infestation in Hong Kong more accurately;

(3) specify that the Density Index announced is for reference only, and promptly categorise the index into different levels and provide a descriptor for each level, such that the surveillance data will be more explicit, uniform and comprehensible;

(4) strengthen publicity of the response mechanism activated by surveillance indices to raise public awareness and participation;

Anti-mosquito work

(5) devise a mechanism for reviewing mosquito surveillance methodologies and seek expert advice from different sectors to improve strategies and implementation of anti-mosquito work;

(6) draw up appropriate administrative measures to ensure proper recording of control actions taken in survey areas with the index at alert levels for scrutiny where necessary;

Use of mosquito-related complaint data

(7) collate and analyse mosquito-related complaints to gauge public concerns and obtain such information as the districts and locations subjected to higher risk of mosquito infestation, so that it can respond by deploying the manpower and resources of PCTs in a more systematic and efficient manner; and

Supervision of PCTs

(8) comprehensively scrutinise and review the two OMs (i.e. the OM for Pest Control Services and the OM for Management of Pest Control Contracts), with a view to enhancing effectiveness in supervising the PCTs.

34. We are pleased to learn that FEHD is positive towards our recommendations and has started implementation of some of them. We will continue to follow up with the Department until all the recommendations have been fully implemented.

Office of The Ombudsman
July 2021

1

INTRODUCTION

BACKGROUND

1.1 The Food and Environmental Hygiene Department ("FEHD") is responsible for mosquito prevention and control in public places, such as streets, slopes, villages and vacant Government land throughout the territory. Such duties, performed by the Pest Control Advisory Section and the District Environmental Hygiene Offices' ("DEHOs")[1] Pest Control Sections[2] (which supervise the Pest Control Teams ("PCTs"), see **Chapter 5**) under FEHD, include setting up gravidtraps (formerly ovitraps) to monitor the breeding of mosquitoes, clearing stagnant water and spraying chemical insecticides. FEHD also closely liaises with other Government departments and organisations[3], and provides technical support and training to assist in anti-mosquito work at venues and premises under the latter's management.

1.2 There are public views that FEHD's selected locations for setting up gravidtraps are incomprehensive, thereby producing inaccurate survey results. The time lag in FEHD's release of surveillance indices makes it difficult for the public to stay on top of the latest situation. Moreover, the relatively high indices recorded in some districts in certain months as reported by the media indicated serious mosquito infestation in those districts. There are also media reports about FEHD's improper

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1 FEHD has offices in all the 19 administrative districts throughout Hong Kong, Kowloon, the New Territories and the outlying islands, namely Central and Western, Eastern, Southern, Wan Chai, Islands, Yau Tsim, Mong Kok, Sham Shui Po, Kowloon City, Wong Tai Sin, Kwun Tong, Tsuen Wan, Kwai Tsing, North, Tai Po, Sai Kung, Sha Tin, Tuen Mun and Yuen Long DEHOs.

2 As at December 2020, FEHD's Pest Control Advisory Section had a staff of 97; its Pest Control Sections comprised 740 in-house members and 2,178 frontline members of contractors' roving teams.

3 Including the Development Bureau ("DEVB"), the Education Bureau ("EDB"), the Agriculture, Fisheries and Conservation Department ("AFCD"), the Architectural Services Department ("ArchSD"), the Buildings Department ("BD"), the Civil Engineering and Development Department ("CEDD"), the Correctional Services Department, the Drainage Services Department ("DSD"), the Electrical and Mechanical Services Department ("EMSD"), the Environmental Protection Department ("EPD"), the Government Logistics Department ("GLD"), the Hospital Authority ("HA"), the Department of Health ("DH"), the Highways Department ("HyD"), the Home Affairs Department ("HAD"), the Housing Department ("HD"), the Information Services Department ("ISD"), the Immigration Department ("ImmD"), the Labour Department ("LD"), the Lands Department ("LandsD"), the Leisure and Cultural Services Department ("LCSD"), the Marine Department ("MD"), the Social Welfare Department ("SDW"), the Transport Department ("TD") and the Water Supplies Department ("WSD").

management over the Pest Control Sections leading to ineffective mosquito prevention and control.

1.3 The mosquito problem is a public concern. The humid and rainy weather during spring and summer in Hong Kong provides an ideal breeding environment for mosquitoes. Mosquito infestation would not only be a nuisance to daily life, but also spread deadly diseases such as dengue fever and Japanese encephalitis ("JE"). According to information from the Centre for Health Protection ("CHP"), the number of dengue cases in Hong Kong increased over the past few years, from 124 cases in 2016 to 198 cases in 2019. Such a rising trend should not be taken lightly. FEHD's anti-mosquito work is, therefore, of paramount importance. This direct investigation is initiated to examine how FEHD handles the mosquito problem, encompassing the management of PCTs, the assessment of mosquito infestation and the preventive and control measures taken, in order to analyse its work effectiveness and make recommendations for improvement where necessary.

PROCESS OF INVESTIGATION

1.4 On 17 August 2020, we declared a direct investigation against FEHD pursuant to section 7(1)(a)(ii) of The Ombudsman Ordinance, with a press release issued on 20 August to invite public views on this subject. Subsequently, a written submission was received from a member of the public, who was concerned about the locations selected by FEHD for mosquito control and the use of chemical insecticides. We also invited three departments in frequent contact with FEHD, namely AFCD, HD and LCSD, to provide information about their collaboration with FEHD in mosquito control.

1.5 On 30 April 2021, we issued a draft investigation report to FEHD for comments. FEHD replied on 2 June 2021. This final report, upon considering and duly incorporating comments from the Department, was completed on 20 July 2021.

2

SURVEILLANCE PROGRAMME

OVERALL STRATEGY

2.1 The Pest Control Steering Committee ("PCSC")[4], chaired by the Food and Health Bureau, formulates the pest control strategies for Government departments. It aims at fostering inter-departmental collaboration, creating a platform to keep departments abreast of the pest problems in Hong Kong, and reviewing the effectiveness of pest control on a regular basis. As one of the participating departments, FEHD is responsible for implementing the strategies and action plans drawn up by PCSC. It also renders expert advice and technical support to PCSC on pest control matters, such as analysing and reporting the condition of mosquito infestation in different districts across the territory, testing innovative technologies for mosquito control, making suggestions on control measures to other participating departments, and coordinating the relevant operations.

2.2 The basic strategy set by PCSC for mosquito control is strengthening prevention, coordination and surveillance. In 2020, PCSC's targets were continuing prevention of local dengue cases, further bringing down the Gravidtrap Index (see **paras. 2.21–2.23**), and compiling and releasing the Density Index for quantifying the activities of *Aedes albopictus* (generally known as "Asian Tiger Mosquito") (see **para. 2.26**).

OVERVIEW OF MOSQUITO VECTORS

2.3 According to FEHD's information, around 70 mosquito species have been found locally. FEHD's surveillance targets are such species as *Aedes albopictus*, *Culex tritaeniorhynchus* and *Anopheles*, being the vector of dengue, JE and malaria respectively. Other species, which only cause a nuisance to humans but do not transmit diseases, are not covered in FEHD's routine surveillance. The major objective of

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4 PCSC members include representatives from DEVB, EDB, AFCD, ArchSD, BD, CEDD, DH, DSD, EMSD, EPD, FEHD, the Government Property Agency, HyD, HAD, HA, HD, ISD, LandsD, LCSD, MD, SWD, TD and WSD.

FEHD's anti-mosquito work is to prevent and control vector-borne diseases. As regards the environmental nuisance caused by mosquitoes, FEHD tackles it concurrently with its control of mosquito vectors and handling of public complaints about mosquito infestation.

Culex Tritaeniorhynchus, Vector of JE

2.4 JE is spread to humans mainly through the bite of *Culex tritaeniorhynchus* mosquitoes infected by feeding on pigs and waders with the virus. According to information from DH's CHP, most people who get infected experience no apparent or only mild symptoms such as fever and headache. More severe infections are characterised by high fever, delirium, etc., and the fatality rate can be as high as 30% among patients with such symptoms. Between 2015 and 2019, the number of JE cases reported in Hong Kong ranged from 0 to 5 yearly. In this connection, FEHD has identified, based on past survey results, eight at-risk districts, namely Tuen Mun, Yuen Long, Sai Kung, North, Sham Shui Po, Southern, Eastern and Kwai Tsing. Samples of adult mosquitoes are collected for testing monthly from pig farms, wader habitats or places with local infections in those districts. If the JE virus is found in the samples, FEHD will carry out targeted anti-mosquito operations according to the protocol for handling local JE cases, including application of larvicides and spraying of adulticides within the 2-km radius of spots where infected samples were found.

Anopheles, Vector of Malaria

2.5 FEHD pointed out that Hong Kong has not reported any local case of malaria since 1999. For the control of *Anopheles*, a vector of malaria, FEHD periodically carries out preventive measures against *Anopheles* breeding at more than 600 hill streams (mostly in urban areas and near the new towns) throughout the territory, and collects mosquito samples from other hill streams which are potential breeding sites of *Anopheles* to assess its distribution and the risk of malaria transmission. Anti-mosquito operations will be carried out where necessary.

Aedes Albopictus, Vector of Dengue

2.6 Dengue fever is transmitted to humans through the bite of infected female mosquitoes of the species *Aedes aegypti* and *Aedes albopictus*. Since *Aedes aegypti* has not been found locally, *Aedes albopictus* is the major vector of dengue in Hong Kong. According to CHP's information, dengue viruses can lead to dengue fever and severe

dengue. Dengue fever is clinically characterised by high fever, severe headache, nausea and vomiting. The symptoms of severe dengue are generally more serious, including circulatory failure, shock and even death. Between 2016 and 2020, the number of dengue cases reported in Hong Kong ranged from 22 to 198 yearly, most being imported cases (see **para. 4.10 and Table 10**). Since the activities of *Aedes albopictus* are not confined to any particular areas, FEHD has to conduct territory-wide surveillance to assess its distribution in different districts. The World Health Organisation ("WHO") recommended larval, pupal and adult surveys for the calculation of different indices (such as the container index, the house index and the ovitrap index) to estimate mosquito abundance. Given that *Aedes albopictus* mosquitoes tend to live outdoors and the local housing environment is dominated by multi-storey buildings, FEHD considered the setting up of ovitraps for outdoor survey and surveillance a suitable approach.

DENGUE VECTOR SURVEILLANCE PROGRAMME

2.7 In 2003, FEHD introduced the Dengue Vector Surveillance Programme ("DVS Programme") to monitor the breeding of *Aedes albopictus* in selected survey areas[5] and evaluate the extensiveness of its distribution in the community. Other mosquito species are not covered in the DVS Programme. Based on WHO's recommendations, FEHD has selected those densely populated areas (such as schools, housing estates and hospitals) and areas with local dengue cases for surveillance.

2.8 In 2004, FEHD extended the DVS Programme to the major ports in Hong Kong, which were categorised into six groups, namely Hong Kong International Airport, Cross Boundary Checkpoints on Land, Cross Boundary Ferry Piers, Public Cargo Working Areas, Private Cargo Working Areas and Container Terminals.

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[5] The survey areas distribute throughout the 19 administrative districts in Hong Kong. Depending on local situations, each district has one to five survey areas for surveillance of *Aedes albopictus*.

Surveillance with Ovitraps before April 2020

<u>Ovitrap Index</u>

2.9 Before April 2020, FEHD used ovitraps[6] as the apparatus to survey *Aedes albopictus* (see **Figure 1**). After setting up ovitraps in each survey/port area, FEHD periodically enumerated the ovitraps with the presence of ***Aedes albopictus* eggs or larvae** (referred to as "*Aedes*-positive") for calculating the Ovitrap Index[7], which can reflect the extensiveness of *Aedes albopictus* in that survey/port area.

Figure 1: Ovitrap (Source: FEHD)



2.10 The Ovitrap Index was classified into four levels (see **Table 1**), of which Levels 3 and 4 (with an index at 20% or above) were alert levels. FEHD's PCTs would take corresponding control actions (see **Table 8**) based on the index levels.

Table 1: Classification of Ovitrap Index ("OI")

Level of OI	**Range of OI**	**Infestation of *Aedes albopictus***
1	OI < 5%	A small portion of the survey/port area was infested. The number of *Aedes*-positive ovitraps should be less than two. Distribution of *Aedes albopictus* was limited.

6 The ovitrap is a conical plastic container tapered at the bottom with an approximate capacity of 200 ml. It contains water and has an umbrella-shaped cover to lure *Aedes albopictus* mosquitoes to enter and lay eggs. Designed specifically based on the oviposition behaviour of *Aedes albopictus*, the ovitrap is ineffective for attracting other species.

7

$$\text{Ovitrap Index} = \frac{\text{Number of ovitraps with presence of } \textit{Aedes albopictus} \text{ eggs or larvae}}{\text{Total number of ovitraps retrieved from a survey/port area}} \times 100\%$$

2	5% ≤ OI < 20%	Certain parts of the survey/port area were infested. While the distribution of *Aedes albopictus* was not widespread, proper control measures should be taken to prevent aggravation.
3 **(Alert level)**	20% ≤ OI < 40%	At least one-fifth of the survey/port area was infested, indicating extensive distribution of the vector.
4 **(Alert level)**	OI ≥ 40%	Almost half of the survey/port area was infested, indicating very extensive distribution and probably high density of the vector.

2.11 To prevent inadvertent spraying of insecticides into the ovitraps during anti-mosquito work and to detect tampering, all ovitraps were covered and sealed. In case more than 10% of the ovitraps were tampered, FEHD would exclude the Ovitrap Index obtained in the relevant survey/port area and arrange another around of survey as soon as practicable. Otherwise, FEHD would state the reason when releasing the surveillance results. For instance, in September 2018 it was unable to conduct another round of survey due to the passage of Super Typhoon Mangkhut.

<u>Setting up ovitraps</u>

2.12 Before June 2020, FEHD had set up around 3,200 ovitraps in 57 survey areas. The number of ovitraps in each survey area depended mainly on the number and distribution of private/public estates and livelihood facilities (such as hospitals, parks and schools) within the area. In more densely populated survey areas, 55 to 60 ovitraps with a distance of 100 metres in between (as the flight range of *Aedes albopictus* is normally within 100 metres) were generally placed at outdoor locations. The scope covered was around 0.55 to 0.6 square kilometres (an area approximately equivalent to 75 to 82 standard football pitches) other than certain exceptions. For instance, only 38 ovitraps were placed in Yau Tong because the more densely populated locations in the vicinity were designated to other survey areas, such as Kwun Tong Central and Lam Tin. Surveillance was also conducted in rural areas which have lower population density but local dengue case(s). Fewer ovitraps, ranging from 20 to 30, were placed in those survey areas mainly to cover locations associated with local dengue cases and near more populated villages.

2.13 The number of ovitraps in port areas was based on the provision under Annex

5[8] to the International Health Regulations ("IHR") 2005[9]. It was required to cover a minimum area of 400 metres from the ports under surveillance to protect travellers, cargo and point of entry facilities from the nuisance and threat of vectors. For instance, with its numerous immigration facilities including the main airport buildings and aprons, the ferry pier, Government office buildings and cargo working areas on the airport island, there were 761 ovitraps placed in the Hong Kong International Airport, hence a larger coverage than other port areas, to satisfy the above provision. Same as in survey areas, ovitraps were set at a distance of 100 metres in principle. However, some ovitraps were placed at indoor immigration facilities in port areas. Owing to internal factors such as the office and floor layouts, flow of passengers and actual operations of checkpoint personnel inside the buildings, the distance between some ovitraps might be less than 100 metres.

2.14 At the end of each year, FEHD would review any need to have more or less survey/port areas and ovitraps. Factors for consideration include the local situation of dengue fever (such as any local cases), urban development and demands from members of the community.

<u>Surveillance process in survey areas</u>

2.15 In each survey area, a two-week surveillance of *Aedes albopictus* was conducted by FEHD monthly. On the first day of surveillance, a specified number of ovitraps were placed in the survey area, to be retrieved after one week to check for the presence of *Aedes albopictus* eggs or larvae. Another batch of ovitraps were placed immediately upon retrieval of the first batch to start the second week's surveillance. The retrieved ovitraps would be incubated for one week in the laboratory for any eggs to hatch, so as to confirm the larvae if belong to the species of *Aedes albopictus*. The percentages of *Aedes*-positive ovitraps in the first and second weeks were recorded respectively as the First Phase and Second Phase Ovitrap Indices (collectively referred to as "Phased OIs"). The *Aedes*-positive results of two weeks were combined to obtain the Area Ovitrap Index ("AOI") for a particular survey area (see **Table 2**).

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8 The Annex stipulates that States Parties shall establish programmes to control vectors that may transport an infectious agent that constitutes a public health risk to a minimum distance of 400 metres from those areas of point of entry facilities that are used for operations involving travellers, conveyances, containers, cargo and postal parcels.

9 According to DH's information, the IHR (2005), effective since 15 June 2007, is an international legal instrument binding on all WHO Member States including the People's Republic of China. To bring the local legal framework in line with the requirements of the IHR (2005), the Prevention and Control of Disease Ordinance was implemented in July 2008 to prevent the introduction into, the spread in and the transmission from Hong Kong of any disease, source of disease or contamination.

2.16 FEHD gave an illustration using the data of the Ovitrap Index recorded for a survey area in October 2018 (see **Appendix 1**).

2.17 Subsequently, FEHD obtained the Monthly Ovitrap Index ("MOI") by dividing the sum of *Aedes*-positive ovitraps found in all survey areas by the total number of ovitraps retrieved from all survey areas (see **Table 2**). The MOI could represent the overall situation of all survey areas in that particular month.

Table 2: Descriptors of Ovitrap Indices in survey areas

Name of Index		Descriptor
First Phase Ovitrap Index	Collectively referred to as Phased OIs	Percentage of *Aedes*-positive ovitraps found on-site in the first week against the total number of ovitraps retrieved from a particular survey area
Second Phase Ovitrap Index		Percentage of *Aedes*-positive ovitraps after incubation for one week and found on-site in the second week against the total number of ovitraps retrieved from a particular survey area
Area Ovitrap Index ("AOI")		Percentage of *Aedes*-positive ovitraps against the total number of ovitraps retrieved monthly from a particular survey area
Monthly Ovitrap Index ("MOI")		Percentage of *Aedes*-positive ovitraps against the total number of ovitraps retrieved monthly from all survey areas

<u>Surveillance process in port areas</u>

2.18 FEHD conducted continuous surveillance for all port areas on a monthly basis. At the beginning of each month, a specified number of ovitraps were placed in each port area, to be retrieved by the end of the week to check for the presence of *Aedes albopictus* eggs or larvae. The retrieved ovitraps would be incubated for one week in the laboratory to let those unidentified *Aedes albopictus* eggs hatch into larvae. The percentage of *Aedes*-positive ovitraps was recorded as the Provisional Ovitrap Index of each port area. The above surveillance process was repeated every week. At the end of each month, FEHD would combine the weekly results to obtain the monthly Ovitrap

Index for each port area.

2.19 FEHD calculated the Port Ovitrap Index ("POI") for each group of port areas (see **para. 2.8**) based on the cumulative number of *Aedes*-positive ovitraps against the total number of ovitraps retrieved in that month. The Port Monthly Ovitrap Index ("PMOI") would be further obtained by the number of *Aedes*-positive ovitraps against the total number of ovitraps retrieved from all port areas (see **Table 3**).

Table 3: Descriptors of Ovitrap Indices in port areas

Name of Index	Descriptor
Port Ovitrap Index ("POI")	Percentage of *Aedes*-positive ovitraps against the total number of ovitraps retrieved monthly from each group of port areas (six groups in total)
Port Monthly Ovitrap Index ("PMOI")	Percentage of *Aedes*-positive ovitraps against the total number of ovitraps retrieved monthly from all port areas

2.20 FEHD gave an illustration using the data of August 2018 recorded for a port area under the group of Public Cargo Working Areas (see **Appendix 2**).

Surveillance with Gravidtraps since April 2020

Gravidtrap Index

2.21 Since April 2020, FEHD has used gravidtraps[10] (see **Figure 2**) to replace ovitraps for dengue vector surveillance.

2.22 Gravidtrap, similar to ovitrap in appearance, has a larger capacity (increased from 200 ml to 600 ml) and a glue board inside for capturing egg-laying adult mosquitoes (see **Figure 3**) (see **Appendix 3** for the operating principle of gravidtrap). Hence, the Gravidtrap Index is calculated based on the numberof traps with **adult mosquitoes collected**[11].

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[10] FEHD had considered introducing the gravidtrap currently used in Singapore. However, due to the difference in local situation, FEHD eventually decided to develop a model suitable for Hong Kong.

[11]

$$\text{Gravidtrap Index} = \frac{\text{Number of gravidtraps with presence of } \textit{Aedes albopictus} \text{ adult mosquitoes}}{\text{Total number of gravidtraps retrieved from a survey/port area}} \times 100\%$$

Figure 2: Gravidtrap (Source: FEHD)



Figure 3: Gravidtrap with an adult mosquito (Source: FEHD)



2.23 The Gravidtrap Index is calculated on the same principle as the Ovitrap Index, i.e. quantifying the extensiveness of mosquito distribution based on the percentage of *Aedes*-positive traps against the total number of traps retrieved. Hence, both indices have the same classification for indicating the levels of mosquito infestation.

Number of survey/port areas, surveillance duration and process

2.24 As at April 2021, FEHD had set up 3,440 gravidtraps in 64 selected survey areas[12] in 19 administrative districts (see **Figure 4**), and 1,558 gravidtraps in 34 port areas[13] (see **Figure 5**).

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12 As at April 2021, the 64 survey areas selected by FEHD were: (Central and Western) Central and Admiralty, Sheung Wan and Sai Ying Pun, Sai Wan; (Eastern) Chai Wan West, Shau Kei Wan and Sai Wan Ho, North Point; (Southern) Aberdeen and Ap Lei Chau, Pok Fu Lam, Deep Water Bay and Repulse Bay; (Wan Chai) Tin Hau, Wan Chai North, Happy Valley; (Islands) Cheung Chau South, Cheung Chau North, Tung Chung; (Yau Tsim) Tsim Sha Tsui, Tsim Sha Tsui East; (Mong Kok) Mong Kok; (Sham Shui Po) Lai Chi Kok, Sham Shui Po East, Cheung Sha Wan; (Kowloon City) Kowloon City North, Hung Hom, Ho Man Tin, Lok Fu West, Kai Tak North; (Wong Tai Sin) Wong Tai Sin Central, Wong Tai Sin West, Diamond Hill, Ngau Chi Wan; (Kwun Tong) Kwun Tong Central, Lam Tin, Yau Tong, Kowloon Bay; (Sai Kung) Tseung Kwan O West, Tseung Kwan O East, Tseung Kwan O North, Sai Kung Town, Ngau Liu and Muk Min Shan; (Sha Tin) Ma On Shan, Sha Tin East, Tai Wai, Sha Tin Town Centre and Fo Tan; (Tai Po) Tai Po West, Tai Po East; (North) Fanling, Sheung Shui; (Yuen Long) Tin Shui Wai, Yuen Kong, Yuen Long Town Centre, Ki Lun Shan, Sung Shan; (Tuen Mun) Tuen Mun South, Tuen Mun North, Tuen Mun West, So Kwun Wat; (Tsuen Wan) Tsuen Wan Town Centre, Tsuen Wan West, Ma Wan, Sheung Kwai Chung; (Kwai Tsing) Kwai Chung, Lai King, Tsing Yi South, Tsing Yi North.

13 As at April 2021, the 34 port areas selected by FEHD were: Hong Kong International Airport, Express Rail Link West Kowloon Control Point, Hong Kong-Zhuhai-Macao Bridge Hong Kong Port, Hung Hom Control Point, Lo Wu Control Point, Lok Ma Chau Control Point, Lok Ma Chau Spur Line Control Point, Man Kam To Control Point, Sha Tau Kok Control Point, Shenzhen Bay Control Point, Heung Yuen Wai Boundary Control Point, Sheung Shui Slaughterhouse, China Merchants Wharf, Yuen Fat Wharf, River Trade Terminal, Hong Kong-Macau Ferry Terminal, China Ferry Terminal and Ocean Terminal, Kai Tak Cruise Terminal, Tuen Mun Ferry Terminal, Container Terminal No. 1, Container Terminal No. 2, Container Terminal No. 3, Container Terminal No. 4, Container Terminal No. 5, Container Terminal No. 6, Container Terminal No. 7, Container

Figure 4: Surveillance with gravidtrap in Yau Tong (survey area) (Source: FEHD)



Figure 5: Surveillance with gravidtrap at Heung Yuen Wai Boundary Control Point (port area) (Source: FEHD)



2.25 The surveillance duration for survey areas remains to be two weeks, while continuous surveillance is conducted in port areas as before. Nonetheless, gravidtraps capture egg-laying adult mosquitoes directly, rendering incubation in laboratory for unidentified eggs unnecessary, and thereby shortening the time for index compilation. For survey areas, FEHD uses the data obtained at the end of the first week to calculate the First Phase Gravidtrap Index. The data obtained at the end of the second week is combined with the first week's data to calculate the Area Gravidtrap Index ("AGI") for each survey area, and the Monthly Gravidtrap Index ("MGI") for all survey areas across the territory. In other words, after using gravidtraps for surveillance, it takes only two weeks rather than three weeks previously to calculate the AGI By the same token, the time required for calculating the Port Gravidtrap Index ("PGI") and Port Monthly Gravidtrap Index ("PMGI") is also one week shorter than before.

Terminal No. 8, Container Terminal No. 9, Chai Wan Public Cargo Working Area, New Yau Ma Tei Public Cargo Working Area, Rambler Channel Public Cargo Working Area, Stonecutters Island Public Cargo Working Area, Tuen Mun Public Cargo Working Area and Western District Public Cargo Working Area.

New Density Index

2.26 In addition to the Gravidtrap Index, FEHD also enumerates the average number of *Aedes albopictus* mosquitoes collected per *Aedes*-positive gravidtrap to quantify the level of mosquito activities in each survey/port area, known as the Density Index[14]. The Density Indices include the First Phase Density Index, Area Density Index and Monthly Density Index for survey areas, and the Port Density Index and Port Monthly Density Index for port areas (see **Table 4**). For instance, if 10 *Aedes albopictus* mosquitoes are collected by 5 gravidtraps in a survey/port area, the Density Index for that survey/port area would be 2 (i.e. the result of 10 divided by 5). FEHD is collecting the Density Indices from all survey/port areas to understand their range, with a view to drawing up proper classification and descriptor for each level for reference by the public and stakeholders. FEHD explained that it needs to collect two years' data for scientific collation and analysis because the breeding of *Aedes albopictus* is seasonal and the weather patterns differ year from year.

Table 4: Descriptors of Density Indices

Name of Index	Descriptor
For survey areas	
First Phase Density Index	Average number of *Aedes albopictus* mosquitoes per *Aedes*-positive gravidtrap in the first week
Area Density Index	Average number of *Aedes albopictus* mosquitoes per *Aedes*-positive gravidtrap in the month
Monthly Density Index	Monthly average number of *Aedes albopictus* mosquitoes per *Aedes*-positive gravidtrap in all survey areas
For port areas	
Port Density Index	Monthly average number of *Aedes albopictus* mosquitoes per *Aedes*-positive gravidtrap in each of the six groups of port areas

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$$\text{Density Index} = \frac{\text{Number of } \textit{Aedes albopictus} \text{ adult mosquitoes collected}}{\text{Number of } \textit{Aedes}\text{-positive gravidtraps retrieved from a survey/port area}}$$

Port Monthly Density Index	Monthly average number of *Aedes albopictus* mosquitoes per *Aedes*-positive gravidtrap in all port areas

SURVEILLANCE INDICES OF SURVEY AREAS

2.27 According to the annual average Ovitrap/Gravidtrap Index for all survey areas (i.e. the percentage of *Aedes*-positive ovitraps/gravidtraps against the total number of traps retrieved in the whole year) released by FEHD between 2016 and 2020 (see **Figure 6**), the overall index of *Aedes albopictus* in Hong Kong remained low with a slightly upward trend.

Figure 6: Annual average Ovitrap/Gravidtrap Indices between 2016 and 2020 (Source: FEHD)



2.28 As regards individual survey areas, FEHD's data shows that the number and frequency of survey areas with an index at Levels 3 and 4 (alarm levels) increased year-on-year between 2016 and 2020, except a slight downturn in 2019 (see **items (b) and (d) in Table 5**). The number of such survey areas ranged from 15 in 2016 at the lowest to 30 in 2020 at the highest. The frequency also nearly doubled, from 21 in 2016 at the lowest to 37 in 2020 at the highest. Nevertheless, there was no significant

fluctuation of the MOIs/MGIs recorded for survey areas, all of which ranged between 0% and 18.1%, or Levels 1 and 2 (see **item (e) in Table 5**).

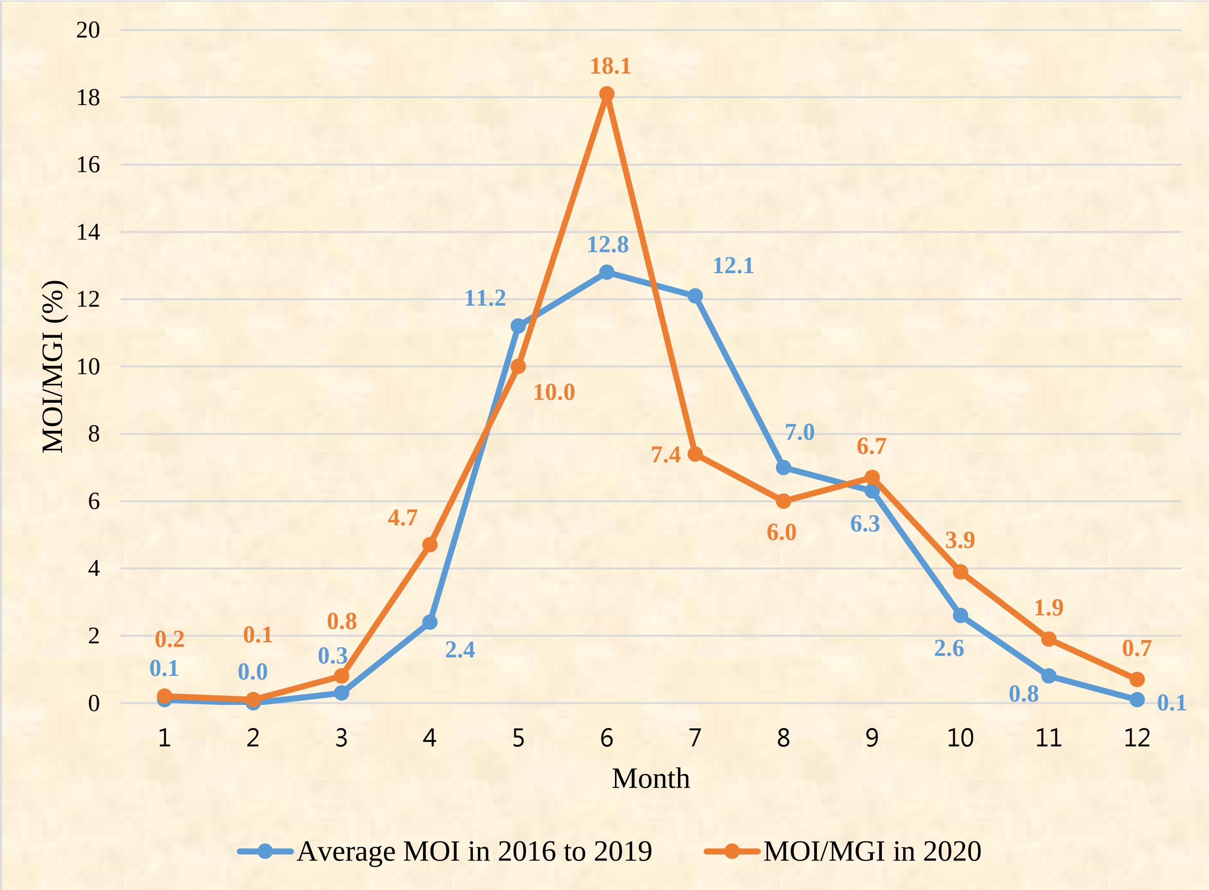
Table 5: Ovitrap/Gravidtrap Indices of all survey areas between 2016 and 2020

		2016	2017	2018	2019	2020
(a)	**Total no. of survey areas**	52	52	57#	57	62*
(b)	**No. of survey areas with AOI/AGI at Levels 3 and 4**	15	18	26	20	30
(c)	**Percentage [(b)/(a)] x 100%**	28.8%	34.6%	45.6%	35.1%	48.4%
(d)	**No. of AOIs/AGIs at Levels 3 and 4 (more than one for some survey areas)**	21	26	35	29	37
(e)	**MOI/MGI of survey areas**	0% - 13.5%	0% - 14.2%	0% - 11.7%	0.1% - 16.0%	0.1% - 18.1%

Since July 2018, the number of survey areas has increased from 52 to 57.
* Since June 2020, the number of survey areas has increased from 57 to 62.

2.29 In its monthly press release regarding the Ovitrap/Gravidtrap Index, FEHD usually highlights the MOI/MGI to explain whether the threats posed by *Aedes albopictus* are serious. On its website, FEHD also provides a multi-year (five-year) comparison on the trend of the MOI/MGI (see **Figure 7**). FEHD explained that mosquito infestation in Hong Kong is highly seasonal. During the hot and rainy months in spring and summer (May to September), mosquito infestation is more extensive, with a relatively high Ovitrap/Gravidtrap Index recorded for a number of survey areas. In autumn and winter, mosquito infestation is less serious.

Figure 7: Trend of MOI/MGI between 2016 and 2020
(Source: FEHD)



2.30 For easy reference, a monthly breakdown of survey areas with an AOI/AGI at different levels in 2020 is given in **Table 6**. It is noted that between May and September, the number of survey areas with an index at Level 2 or above ranged from 31 to 61, significantly more than 0 to 22 in other months, indicating that infestation of *Aedes albopictus* was more serious in those months.

Table 6: Data of Ovitrap/Gravidtrap Index in 2020
(Number of survey areas with index at different levels)

	No. of survey areas with index at different levels				Total no. of survey areas	MOI/MGI (Level)
	Level 1	Level 2	Level 3	Level 4		
	0%-<5%	5%-<20%	20%-<40%	≥40%		
Jan	57	0	0	0	57	0.2% (Level 1)
Feb	57	0	0	0	57	0.1% (Level 1)
Mar	56	1	0	0	57	0.8% (Level 1)
Apr	35	21	1	0	57	4.7% (Level 1)
May	**10**	**43**	**4**	**0**	**57**	**10.0% (Level 2)**
Jun	**1**	**35**	**26**	**0**	**62**	**18.1% (Level 2)**
Jul	**17**	**45**	**0**	**0**	**62**	**7.4% (Level 2)**
Aug	**31**	**30**	**1**	**0**	**62**	**6.0% (Level 2)**
Sep	**30**	**28**	**4**	**0**	**62**	**6.7% (Level 2)**
Oct	49	12	1	0	62	3.9% (Level 1)
Nov	54	8	0	0	62	1.9% (Level 1)
Dec	59	3	0	0	62	0.7% (Level 1)

Note: SinceJune 2020, the number of survey areas has increased from 57 to 62.

3

RELEASE OF INFORMATION AND RESPONSE MECHANISM

RELEASE OF INFORMATION

Information for the Public

3.1 On its website, FEHD released to the public the surveillance indices obtained under the DVS Programme, including the AOI and MOI for survey areas (see **paras. 2.15 and 2.17**) and the POI and PMOI for port areas (see **para. 2.19**). The AOI of each survey area was immediately uploaded to FEHD's website upon completion of the monthly survey for that area. From September 2018, in addition to the above indices, FEHD would also first release on its website the Phased OIs (see **para. 2.15**) within two to three days after retrieval of ovitraps from each survey area.

3.2 In April 2020, FEHD started using gravidtraps instead of ovitraps for surveillance, and the Ovitrap Index was renamed Gravidtrap Index. Concurrently, FEHD launched a new index, called the Density Index, to indicate the level of *Aedes albopictus* activities.

3.3 At present, FEHD releases on its website[15] the following ten items of data (see **Table 7**) in relation to Gravidtrap Index and Density Index:

Table 7: Data of Gravidtrap Index and Density Index released monthly on FEHD website

	Survey area	Port area
Gravidtrap Index	First Phase Gravidtrap Index *(for each survey area)* AGI	PGI *(for each group of port areas)* PMGI

[15] Website: https://www.fehd.gov.hk/english/pestcontrol/dengue_fever/index.html

	(for each survey area) MGI *(for all survey areas)*	*(for all groups of port areas)*
Density Index	First Phase Density Index *(for each survey area)* Area Density Index *(for each survey area)* Monthly Density Index *(for all survey areas)*	Port Density Index *(for each group of port areas)* Port Monthly Density Index *(for all groups of port areas)*

Substance of Information

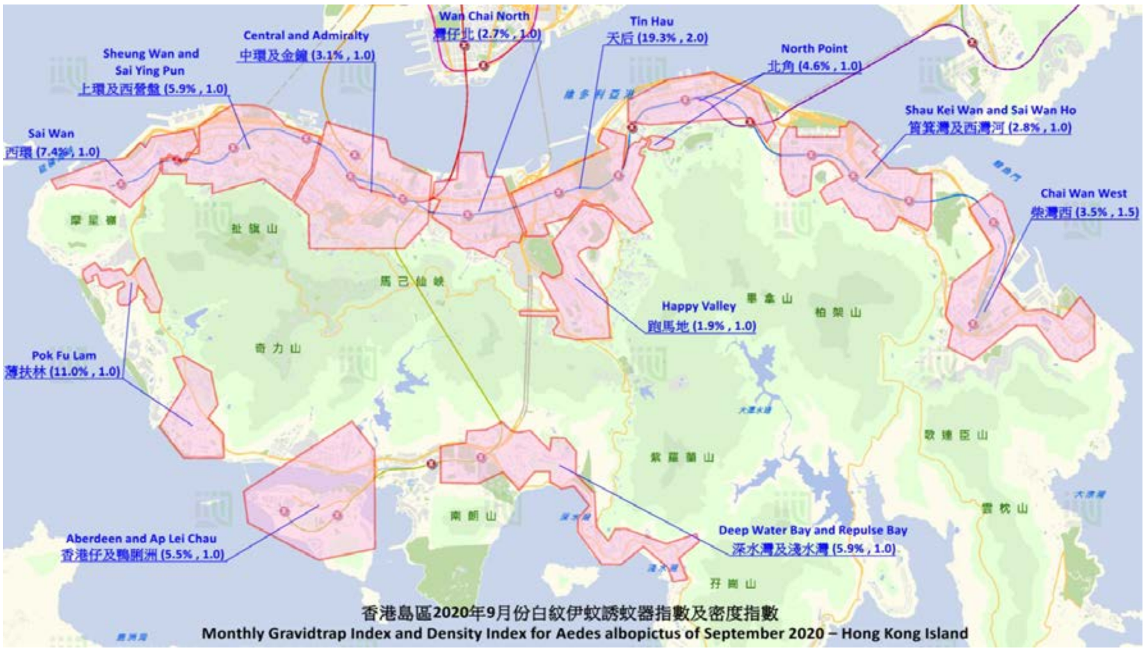
3.4 At present, FEHD regularly releases a series of Gravidtrap Indices and Density Indices recorded for survey/port areas (see **para. 3.3**). Its website mainly provides the indices of all survey areas and six groups of port areas in table form (see **Figure 8**), with hyperlinks to graphic maps showing the coverage and index of each survey area and each group of port areas (see **Figure 9**).

Figure 8: Gravidtrap Indices of survey areas in 2020 (table of figures)
(Source: FEHD website)

香港 (地圖) ← Hyperlink (Figure 9)

行政區	調查地區		四月	五月	六月	七月	八月	九月
中西區	中環及金鐘	分區誘蚊器指數	1.0%	2.0%	9.5%	4.1%	2.0%	3.1%
		分區密度指數	1.0	1.0	1.3	1.3	1.0	1.0
	上環及西營盤	分區誘蚊器指數	3.4%	12.5%	15.0%	5.0%	1.7%	5.9%
		分區密度指數	1.0	1.3	1.4	1.0	1.0	1.0
	西環	分區誘蚊器指數	3.7%	4.7%	22.4%	7.5%	7.3%	7.4%
		分區密度指數	1.3	1.4	1.8	1.1	1.6	1.0
東區	柴灣西	分區誘蚊器指數	0.0%	2.7%	16.1%	3.5%	0.9%	3.5%
		分區密度指數	N/A	1.0	1.1	1.0	1.0	1.5
	筲箕灣及西灣河	分區誘蚊器指數	1.8%	17.1%	26.8%	19.4%	11.6%	2.8%
		分區密度指數	1.5	1.3	1.4	1.9	1.0	1.0
	北角	分區誘蚊器指數	0.0%	12.0%	30.4%	13.4%	3.8%	4.6%
		分區密度指數	N/A	1.3	1.5	1.3	1.3	1.0
南區	香港仔及鴨脷洲	分區誘蚊器指數	2.8%	18.3%	17.3%	12.7%	4.5%	5.5%
		分區密度指數	1.0	1.4	1.1	1.5	1.0	1.0
	薄扶林	分區誘蚊器指數	3.5%	5.3%	26.4%	10.6%	8.1%	11.0%
		分區密度指數	1.0	1.0	1.6	1.3	1.0	1.0
	深水灣及淺水灣	分區誘蚊器指數	3.4%	11.5%	20.7%	9.4%	7.0%	5.9%
		分區密度指數	1.0	1.0	1.0	1.0	1.0	1.0

Figure 9: Gravidtrap Indices of survey areas in 2020 (graphic map)
(Source: FEHD website)



Information for Departments and Organisations

3.5 In addition to releasing information to the public, after obtaining the Phased Index and AOI/AGI of each survey area every month, FEHD would upload the indices with relevant details, including the locations of *Aedes*-positive ovitraps/gravidtraps, the number of *Aedes albopictus* mosquitoes collected, the cumulative number of *Aedes*-positive traps, and the areas within the 100-metre radius of those traps, to the Geospatial Information Hub of LandsD. All DEHOs and 23 relevant bureaux/departments/ organisations (see **Appendix 4**) are also notified by email for timely adoption of strategic anti-mosquito measures.

3.6 Meanwhile, the management authorities of relevant boundary control points, DEHOs, HAD's District Offices and DH's Port Health Division are notified by email of the surveillance results obtained in port areas, including the Provisional Index and Monthly Index of each port area, POI/PGI and PMOI/PMGI, together with a map of the boundary control points showing the locations of *Aedes*-positive ovitraps/gravidtraps and mosquito control advice for them to take follow-up actions.

RESPONSE MECHANISM

3.7 Where a survey area recorded an AOI/AGI at Level 3 or 4 (i.e. with an index at 20% or above), FEHD would activate the response mechanism for coordination of anti-mosquito work with relevant departments and stakeholders.

3.8 Specifically, FEHD would alert relevant bureaux/departments/organisations (see **Appendix 4**) by email to take proper anti-mosquito measures within the 100-metre radius of the *Aedes*-positive ovitraps/gravidtraps. The local DEHO would convene the district anti-mosquito task force meeting, attended by representatives from relevant Government departments and organisations (such as HD, LCSD, HAD, EDB and HA), property management agents and private venues in the district. During the meeting, DEHO would report on the latest condition of mosquito infestation in the district, and discuss with participants how to step up local anti-mosquito operations for bringing the AOI/AGI down to below the target level of 20%. Meanwhile, FEHD would notify the Rapid Alert System ("RAS")[16] subscribers in the survey area, including management offices of residential premises, social welfare facilities, schools, construction sites and public utilities. They are urged to display a specially designed alert notice (see **Figure 10**) in the common areas of their premises to remind occupants and staff to adopt anti-mosquito measures promptly.

Figure 10: Sample alert notice (Source: FEHD)



[16] FEHD has established the RAS on its intranet to store the contact information of all voluntary subscribers in each survey area, including: management offices of residential premises, social welfare facilities, schools, construction sites and public utilities. Where the AOI/AGI of a survey area surges to 20% or above, the local DEHO would use information from the RAS to notify relevant organisations for taking follow-up actions.

3.9 As regards port areas, FEHD has established communication channels (see **para. 3.6**) with the management authorities of all control point facilities and relevant Government departments. Through such channels, FEHD directly notifies them of the surveillance indices obtained in port areas and gives anti-mosquito advice for them to take follow-up actions.

3.10 We have selected a random sample of survey areas with a relatively high AOI in 2018 and 2019 for scrutiny, namely Pok Fu Lam (37.9% in June 2018), Yau Tong (45.1% in July 2018), Wong Tai Sin Central (30.4% in June 2019) and Ma On Shan (42.2% in June 2019). FEHD was requested to provide relevant job records for us to understand how control actions were taken under the response mechanism.

3.11 As shown in its job records, FEHD issued emails to relevant bureaux/ departments/organisations regarding those survey areas with an AOI at Level 3 or 4, advising them to take proper action for mosquito prevention and control within the 100-metre radius of *Aedes*-positive ovitraps. It also notified the RAS subscribers, including management offices of private/public estates, building contractors of construction sites, etc., urging them to display the alert notice and remind occupants and staff to adopt anti-mosquito measures.

3.12 FEHD also provided the minutes of the district anti-mosquito task force meetings convened under the response mechanism in the administrative districts encompassing those survey areas, namely Southern (Pok Fu Lam), Kwun Tong (Yau Tong), Wong Tai Sin (Wong Tai Sin Central) and Sha Tin (Ma On Shan). During the meetings, all DEHOs advised the participating departments and organisations that the relevant survey areas had recorded an AOI at the alert level in the prevailing month. DEHOs also briefed them on the existing and potential breeding sites commonly found in the survey areas, and the proper control measures to be taken. The minutes also show that during the meetings, DEHOs gave details on the locations of *Aedes*-positive ovitraps in the survey areas and their coverage to facilitate anti-mosquito work.

4

IMPLEMENTATION

OVERVIEW

4.1 With reference to the recommendations of WHO and the Centers for Disease Control and Prevention of the United States, FEHD has formulated an integrated pest/vector management approach for implementation of anti-mosquito work as below:

- on the basis of environmental management, improving environmental sanitation to eliminate mosquito breeding sites (see **para. 4.5**);

- using biological agents or chemicals to kill mosquitoes (see **para. 4.5**); and

- conducting public education campaigns focusing on personal protection measures (see **paras. 4.29 and 4.30**).

4.2 FEHD is primarily responsible for mosquito prevention and control in public places. For venues and premises managed by other Government departments, FEHD provides relevant departments with technical support and training to facilitate their implementation of proper anti-mosquito measures (see **para. 4.20**).

4.3 Every year, FEHD convenes meetings under the Inter-departmental Working Group on Pest Prevention and Control to discuss the anti-mosquito work of various departments, and to keep participants abreast of the situation of mosquito-borne diseases in Hong Kong and FEHD's latest strategies and measures for mosquito prevention and control. At the beginning of the annual rainy season or where necessary, DEHOs would convene the district anti-mosquito task force meetings with the district offices of venue/premises management departments for coordination of control actions in the districts. FEHD also launches the annual territory-wide anti-mosquito campaign and thematic special operations (see **paras. 4.21–4.25**) to enhance the preventive and control measures in public places and the areas managed by various departments, as well as promote public awareness of mosquito prevention.

4.4 Additionally, FEHD would obtain information on construction sites/road works from HD and HyD to facilitate the patrols of works sites prone to accumulate water (see **paras. 4.26 and 4.27**). FEHD also works closely with HAD and BD to enhance mosquito prevention and control for on-going minor works projects (see **para. 4.28**).

MOSQUITO PREVENTION AND CONTROL

4.5 As mentioned in **paragraph 4.1**, FEHD has all along been using the integrated pest/vector management approach for mosquito control in Hong Kong. Under this approach, environmental management is coupled with the use of biological agents or chemicals to achieve the best preventive and control effect. The routine work of FEHD's PCTs includes removal of stagnant water and discarded water-holding containers, clearance of clogging matters (such as fallen leaves, twigs and pebbles) from streams and levees, and pruning of overgrown vegetation to prevent mosquito breeding. Where stagnant water cannot be eliminated, larvicides[17] are applied with sprayers or other suitable devices to prevent mosquitoes in aquatic stages from hatching and maturing into adults. For irremovable water bodies not connected to natural water sources, such as abandoned ornamental ponds, edges of streams or water-filled pits along rocky river banks, FEHD would consider releasing larvivorous fish (such as *Poecilia reticulata*) as a biological control agent against mosquito proliferation. On the other hand, when any cases of mosquito-borne diseases (such as dengue) are reported locally, or an increased risk of mosquito-borne diseases being transmitted in the community is identified by FEHD, fogging operations with adulticides would be conducted for rapid reduction of adult mosquitoes, thereby lowering the transmission risk.

4.6 According to the levels of Ovitrap/Gravidtrap Index obtained in survey areas, FEHD would initiate different levels of control actions as specified in its Pest Control Technical Circular (Mosquito) No. 3 ("Technical Circular"). Details are as follows (see **Table 8**):

[17] Such as *Bacillus thuringiensis*, temephos or larvicidal oils.

Table 8: FEHD's control actions according to the levels of Ovitrap/Gravidtrap Index ("OI/GI")

Level of OI/GI	Range of OI/GI	Control actions
1	OI/GI < 5%	Since only a small portion of the survey area was infested, PCT staff would be required to mount a one-off control operation at areas within the 100-metre radius of *Aedes*-positive traps, aimed at elimination of existing or potential breeding sites.
2	5% ≤ OI/GI < 20%	PCT staff should clear stagnant water from all breeding sites as far as possible, and treat those that could not be eliminated with larvicides, followed by weekly inspection to review the situation. Where necessary, larvicides should be applied repeatedly. The weekly programme could be suspended if a negative result is obtained in the next round of surveillance.
3 (Alert level)	20% ≤ OI/GI < 40%	With such a widespread distribution of *Aedes albopictus*, the coverage of anti-mosquito operations should be enlarged. District pest control staff might not be able to handle all the source reduction work. Assistance from other sections should be sought to clear stagnant water from existing and potential breeding sites. Breeding sites that could not be eliminated should be treated with larvicides repeatedly, followed by weekly inspection to review the situation. The weekly programme could be suspended only upon a negative result obtained in the next round of surveillance.
4 (Alert level)	OI/GI ≥ 40%	Apart from removal of stagnant water from breeding sites and larval control, fogging operations with adulticides should be conducted once a week for two consecutive weeks in areas with dense vegetation and population such as housing estates, schools and hospitals for rapid reduction of adult mosquitoes.

4.7 We requested FEHD to give specific details on the control actions taken according to the Technical Circular for the four survey areas with an AOI at Level 3 or 4 (see **para. 3.10**), and provide us with the relevant work records.

4.8 After scrutiny, we confirmed that FEHD has initiated targeted control actions within the 100-metre radius of *Aedes*-positive ovitraps, including application of larvicidal oils and larvicides at breeding sites, removal of stagnant water and fogging operations with adulticides. The DEHOs of certain survey areas (including Wong Tai Sin Central and Ma On Shan) have sought support from other sections for more manpower to handle the control work. Since the areas involve the venues/premises managed by other departments (such as LCSD, HD and HA), these departments were also required to take control actions in tandem. To this end, the DEHOs of certain survey areas (including Wong Tai Sin Central and Ma On Shan) conducted joint inspections with relevant departments. For instance, Wong Tai Sin DEHO conducted a joint inspection with HD and the local District Council members at Wang Tau Hom Estate to provide technical advice on anti-mosquito and cleansing operations. Sha Tin DEHO conducted a joint inspection with representatives from EDB, HAD, DSD, HyD and LCSD in the vicinity of the *Aedes*-positive ovitraps in Ma On Shan , removing stagnant water from the mosquito breeding sites on the spot. Department representatives were reminded to keep track of potential breeding sites and take proper actions where necessary.

4.9 According to the Technical Circular, where a survey area recorded an AOI at Level 3 or 4, FEHD staff are required to treat at-risk places with larvicides repeatedly and conduct weekly inspection. The weekly programme could only be suspended until a negative result is obtained in the next round of surveillance at those places. If the index is at Level 4, fogging operations with adulticides should be carried out for two consecutive weeks to rapidly reduce adult mosquitoes. FEHD asserted that control actions had been taken for the above four survey areas according to the Technical Circular, resulting in a markedly lower AOI (see **Table 9**). Nonetheless, we notice that some of the work records were about the daily routines in those survey areas, with no indication of control actions taken in accordance with the Technical Circular. As such, we are unable to ascertain whether FEHD took actions in those survey areas as required by the Technical Circular.

Table 9: Ovitrap Indices recorded in Pok Fu Lam, Yau Tong, Wong Tai Sin Central and Ma On Shan

Survey area	Pok Fu Lam	Yau Tong	Wong Tai Sin Central	Ma On Shan
Month with AOI at Level 3 or above and AOI recorded	June 2018 (37.9%)	July 2018 (45.1%)	June 2019 (30.4%)	June 2019 (42.2%)
AOI in subsequent months	July 2018 (18.6%)	Aug 2018 (34.7%)	July 2019 (14.7%)	July 2019 (23.4%)
	Aug 2018 (1.7%)	Sep 2018 (5.7%)	Aug 2019 (10.4%)	Aug 2019 (19.5%)

Follow-up Actions for Local Dengue Cases

4.10 According to CHP's data, there was a continuous increase in dengue cases reported in Hong Kong between 2016 and 2020 (except 2020), most of which were imported cases. The number of local infections per year ranged from 1 to 29, or 0.5% to 17.8% (see **Table 10**).

Table 10: Statistics on local dengue cases between 2016 and 2020

	Cases of local infections	Imported cases	Unclassified cases	Total	Percentage of local infections
2016	4	120	0	124	3.2%
2017	1	101	0	102	1.0%
2018	29#	134	0	163	17.8%
2019	1	197	0	198	0.5%
2020	1	21	0	22	4.5%

An outbreak of dengue cases occurred in 2018, with 29 cases of local infections. The sources of infection included the Lion Rock Park and Cheung Chau. Cheung Chau had already been selected as a survey area, while the Lion Rock Park has been covered in Wong Tai Sin Central since November 2018.

4.11 Upon DH's notification of dengue cases, FEHD would conduct vector investigation[18] and anti-mosquito work within the 500-metre radius of the reported locations (such as the patient's residence and workplace). For imported cases, FEHD would treat the area within the 500-metre radius of the reported locations with larvicides for six consecutive weeks. Fogging operations with adulticides would also be carried out on alternate days for the first ten days, followed by weekly fogging (once or twice per week) for another four weeks (28 days) to continuously reduce the number of *Aedes albopictus*. As for reports on local infections, anti-mosquito work will be intensified to prevent community transmission of dengue viruses. In particular, larviciding is extended from six to seven consecutive weeks, and the fogging operations on alternate days are prolonged to 32 days, followed by weekly fogging (once or twice per week) for another two weeks (14 days).

4.12 FEHD stated that upon receiving notification in April 2020 of the first local dengue infection in that year, vector investigation and anti-mosquito work were immediately carried out within the 500-metre radius of the patient's residence (including collection of mosquito samples for dengue virus testing, fogging operations, application of larvicides and larvicidal oils, placement of new mosquito trapping device (see **para. 4.13**), and distribution of leaflet about precautions against dengue fever to residents in the neighbourhood). Concurrently, FEHD stepped up environmental management in the area, including clearance of wastes/stagnant water, removal of objects that accumulate water, and unblocking of drains.

Learning from Overseas Experience and Introducing New Equipment

4.13 To formulate anti-mosquito strategies suitable for local environment and climate, FEHD regularly attends international pest control conferences to obtain the latest experience from the WHO and overseas. Between 2014 and 2018, FEHD officers participated in a number of exchange programmes and international conferences (see **Appendix 5**). In February 2019, FEHD invited the experts of The WHO Western Pacific Regional Office to Hong Kong to give advice on local control against mosquito infestation and vector-borne diseases. In recent years, FEHD introduced a new mosquito trapping device which contains water mixed with an insect growth regulator ("IGR") to inhibit larval development, and fungi to kill adult mosquitoes. Egg-laying female mosquitoes, after dispersing the IGR to other water bodies, will succumb to fungal infection in a few days. According to laboratory and field tests[19], the trapping

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[18] Involving search for existing and potential breeding sites of *Aedes albopictus,* and collection of mosquito samples for testing of dengue viruses.

[19] FEHD conducted field tests for the trapping device at So Kwun Wat, Tuen Mun and the Observatory in Tsim

device proved effective for minimising the proliferation of *Aedes albopictus*. FEHD has placed the trapping device in districts with higher threats of *Aedes albopictus* and promoted, through PCSC, its use to relevant departments/organisations (including LCSD, HD, DH and HA). At present, FEHD already purchased more than 3,000 devices (see **Figure 11**) for use in various districts, and more than 5,500 pieces have been placed by other departments at venues and premises under their purview.

Figure 11: New mosquito trapping device
(Source: FEHD)



4.14 When more serious mosquito infestation is detected (e.g. when the Ovitrap/ Gravidtrap Index is at Level 4), FEHD would conduct fogging operations with chemicals to reduce adult mosquitoes. For this purpose, knapsack ultra-low volume ("ULV") foggers (see **Figure 12**) have been purchased years ago. The fogger can break up liquid adulticides into tiny droplets with a diameter of 5 to 50 microns, capable of suspending in the air to kill adult mosquitoes within the sprayed area.

Sha Tsui in May and July 2019 respectively. Data was simultaneously collected from areas adjacent to the testing sites, which served as a control group for assessing the effectiveness of the trapping device.

Figure 12: Fogging operations with knapsack ULV fogger by FEHD staff (Source: FEHD)



4.15 Recently, FEHD has introduced a large-scale ULV fogger mounted on a rolling cart (see **Figure 13**). Its major advantage is a longer range than the knapsack fogger, making it suitable for fogging operations over a larger area. FEHD purchased the fogger for 17 DEHOs[20] in July 2020.

Figure 13: Large-scale ULV fogger (Source: FEHD)



Enforcement

4.16 Pursuant to section 27(1) of the Public Health and Municipal Services Ordinance ("PHMSO"), where it appears to FEHD that there is, or is likely to be, upon any premises any accumulation of water likely to contain larvae or pupae of mosquitoes, FEHD may, by a notice served on the person responsible for the premises, require him to remove such accumulation of water within such time as may be specified in the notice;

[20] FEHD currently has no plan to purchase the large-scale ULV fogger for DEHOs of the remaining two administrative districts, namely Yau Tsim and Mong Kok, due to the dense population and lack of public places for its deployment in those districts.

or to take such other steps as may be specified in the notice to prevent any accumulation of water, or the existence of larvae or pupae of mosquitoes upon the premises. Any persons who fail to comply with the notice shall be guilty of an offence.

4.17 Pursuant to section 27(3) of the PHMSO, if any larvae or pupae of mosquitoes are found on any premises consisting of a building site, the appointed contractor of the site shall be guilty of an offence. Section 27(3A) of the PHMSO also stipulates that if the existence of such larvae or pupae on any premises (other than those consisting of a building site) is attributable to any act, default or sufferance of any person, such person shall be guilty of an offence.

4.18 Statistics on enforcement actions taken by FEHD between January 2018 and June 2020 regarding mosquito problems are given below (see **Table 11**):

Table 11: Statistics on enforcement actions taken by FEHD between 2018 and June 2020

	Verbal warning	Written warning	Statutory notice	Prosecution	Penalty
2018	20,965	48	10	206	$1,000 to $23,000
2019	15,271	33	21	173	$1,500 to $24,000
Jan to Jun 2020	7,378	28	3	69	$2,000 to $20,000

INTER-DEPARTMENTAL COLLABORATION

4.19 As mentioned in **paragraph 1.4**, we have selected three departments, namely AFCD, HD and LCSD, and invited them to provide information. All three departments gave positive responses to FEHD’s training and technical support, as well as its territory-wide anti-mosquito campaign.

Training and Technical Support

4.20 As at September 2020, details of FEHD's training and technical support provided for the above three departments over the past three years are given below (see **Table 12**):

Table 12: Anti-mosquito training and technical support provided by FEHD for AFCD, HD and LCSD

	AFCD	**HD**	**LCSD**
Type and no. of venues/ premises under management	More than 400 venues and premises, including country parks, animal management centres, vegetable and fish marketing organisations, etc.	188 public housing estates in Hong Kong, including the common parts and facilities within the estates (such as shopping malls, markets, fitness and leisure facilities), and 45 construction sites	More than 1,370 places of recreation and culture, including parks, playgrounds, sports grounds, stadiums, cultural centres, museums and performance venues
Parties responsible for anti-mosquito work of relevant venues/ premises	Depending on the types of venues and premises, anti-mosquito work is carried out by in-house or contractor staff, or by both jointly	Carried out by its contractors or construction sites' building contractors	Carried out by its cleansing contractors
Training provided by FEHD	Its staff members attended two pest control seminars organised by FEHD in 2019 and 2020	Since 2018, more than 600 in-house and contractor staff members have attended 14 pest control courses organised by FEHD	Since 2018, 370 attendances by LCSD staff have been recorded at pest control courses and seminars organised by FEHD
Technical support provided by FEHD	(1) FEHD's suggestion to introduce pest control clauses in the contracts of cleansing service contractors (with a clause template provided) was accepted and implemented; (2) On FEHD's suggestion, the departments have purchased the		

	new mosquito trapping device (see **para. 4.13**) for venues and premises under their management; HD is also exploring the application of the large-scale ULV fogger (see **para. 4.15**) as suggested by FEHD; and (3) FEHD would convene meetings (including under the Inter-departmental Working Group on Pest Prevention and Control, and the district anti-mosquito task force) to discuss the anti-mosquito work of various departments, keep departments abreast of the situation of mosquito-borne diseases in Hong Kong, introduce the latest strategies and measures implemented by FEHD for mosquito prevention and control, and make suggestions to departments for proper control actions against mosquito infestation.

Inter-departmental Anti-mosquito Campaign and Thematic Special Operations

4.21 Every year, FEHD organises the territory-wide anti-mosquito campaign in three phases over 25 weeks[21]. During the campaign, FEHD, jointly with participating bureaux and departments[22], would intensify the preventive and control measures at places under their management, including a series of control actions to clear stagnant water from existing and potential breeding sites and to minimise mosquito infestation. Special attention is paid to areas in close proximity to residential premises, schools, construction sites, hospitals, illegal cultivation sites, waterfront cargo working areas, immigration checkpoints, typhoon shelters and cross boundary ferry terminals. FEHD would also step up publicity and education to raise public awareness of mosquito prevention. FEHD's statistics on the territory-wide anti-mosquito campaigns between 2018 and 2020 are given below (see **Table 13**).

[21] The campaign is implemented in three phases annually: Phase 1 from February to March (4 weeks), Phase 2 from April to June (9 weeks) and Phase 3 from August to October (12 weeks).

[22] Participating bureaux and departments include EDB, AFCD, ArchSD, BD, CEDD, CSD, DSD, EMSD, EPD, GLD, HA, DH, HyD, HAD, HD, ImmD, LD, LandsD, LCSD, MD, SWD, TD and WSD.

Table 13: Statistics on territory-wide anti-mosquito campaigns between 2018 and 2020

Year	Territory-wide anti-mosquito campaign	No. of mosquito breeding sites eliminated	No. of potential breeding sites eliminated	No. of environmental hygiene talks organised
2018	Phase 1	2,035	32,368	62
	Phase 2	6,152	54,256	171
	Phase 3	8,735	63,086	157
2019	Phase 1	2,444	35,355	155
	Phase 2	7,755	53,282	129
	Phase 3	5,207	33,437	50
2020	Phase 1	2,124	27,978	17[23]
	Phase 2	7,397	55,349	58
	Phase 3	8,758	62,587	90

4.22 In between each campaign, FEHD also organises thematic special operations for mosquito prevention and control aiming to reduce the risks of vector-borne diseases and strengthen the effect of the territory-wide anti-mosquito campaign. In deciding the emphases of each thematic special operation, FEHD would review the latest situation of vector-borne diseases in Hong Kong and the indices under the DVS Programme. Taking 2019 and 2020 as example, the emphases of its thematic special operations were as follows (see **Table 14**):

Table 14: Emphases of thematic special operations for mosquito prevention and control in 2019 and 2020

	2019	2020
Phase 1	(1) Places visited by the patients of local dengue infections in	(1) Places visited by the patients of local dengue infections in

[23] To minimise the risk of spreading coronavirus disease 2019 and in response to the Government's policy of social distancing, fewer environmental hygiene talks were organised in Phase 1 of the 2020 anti-mosquito campaign than in the same phase of 2018 and 2019.

	2018; and (2) Survey areas with an AOI at 20% or above (Level 3) in 2018	2018 and 2019; (2) Places visited by the patients of local JE infections in 2019; (3) Survey areas with an AOI at 20% or above (Level 3) in 2019
Phase 2	(1) Places visited by the patients of local dengue infections in 2018; (2) Residences of the patients of imported dengue cases in 2018; (3) Survey areas with an AOI at 20% or above (Level 3) for two consecutive months in 2018; and (4) Survey areas with an AOI at 20% or above (Level 3) in 2019	(1) Places visited by all patients of local dengue infections in 2018, 2019 and April 2020; (2) Places visited by the patients of local JE infections in 2019; and (3) Survey areas with an AOI in 2019 and an AGI between April and June 2020 at 20% or above (Level 3)

4.23 AFCD, HD and LCSD all participated in FEHD's territory-wide anti-mosquito campaigns in the past three years. During the campaign, HD carried out weekly fogging operations for its public housing estates to reduce adult mosquitoes in densely vegetated areas at a distance of 100 to 200 metres from residential premises; eliminated potential breeding sites by pruning weeds, clearing stagnant water and removing discarded containers; and applied larvicides for mosquito control. As suggested by FEHD, HD also paid special attention to common breeding sites, such as nullahs, keyholes of manholes, scaffolding, tree holes and fallen leaves during its patrols and control actions.

4.24 AFCD took proper control actions according to the types of venues and premises, such as patrols and cleansing operations at least once a week for the recreation areas, hiking trails and works sites within country parks. It also minimised mosquito proliferation by pruning weeds, levelling defective surfaces that accumulate water and removing unauthorised cultivation sites and water-holding containers. For the wholesale markets under its management, AFCD conducted daily operations to remove stagnant water, keep drains free of blockage and check water-holding containers. Water bodies prone to attract mosquitoes were treated with larvicides weekly as a precaution against mosquito breeding.

4.25 As regards LCSD, it strengthened the patrol and daily cleansing of facilities at its venues, stepped up enforcement against littering offenders, carried out special anti-mosquito and cleansing operations, and displayed and distributed anti-mosquito publicity materials.

Communication Mechanism

4.26 To target construction sites prone to accumulate water and proliferate mosquitoes, FEHD has in place a communication mechanism with HD and HyD since 2016. Under the mechanism, HD provides details of construction sites under its purview (including the names/locations/types of works projects, parties responsible for the projects, and works commencement and completion dates) every quarter for FEHD to follow up. HyD provides FEHD with details of road works (including the locations of works, parties responsible for the projects, and works commencement and completion dates) daily to facilitate PCTs' routine patrols.

4.27 For more vigorous inspection, FEHD set up four Pest Control Inspection Teams in May 2017. Each team, comprising a Pest Control Inspection Officer and two Foremen, is tasked with inspection of construction sites and enforcement against responsible persons for offences under the PHMSO (see **para. 4.17**). In 2018, 2019 and 2020, FEHD instituted 197, 162 and 154 relevant prosecutions respectively. FEHD provided its inspection and prosecution records for April to June 2019 as below (see **Table 15**):

Table 15: Inspection and prosecution records of Pest Control Inspection Teams

Month	No. of construction sites inspected	No. of prosecutions against construction sites
April 2019	124	14
May 2019	121	15
June 2019	114	19

4.28 In addition, HAD compiles details of the buildings undergoing maintenance or affected by works in the vicinity, which have come to its notice through the provision of building management support services, and forwards to FEHD on a quarterly basis. Also on a quarterly basis, BD extracts details of the buildings involved in projects of

larger scale or higher complexity as reported under the Minor Works Control System, and forwards to FEHD for special attention during its routine patrols.

PUBLIC EDUCATION

4.29 On the public education front, FEHD uses a wide range of promotional channels, including its website, TV/radio announcements and posters displayed at public transportation facilities (e.g. railway and bus stations, and bus exteriors), to remind the public of the importance of mosquito prevention. FEHD also promulgates anti-mosquito messages through the Facebook and Instagram pages of Keep Clean Ambassador "Ah Tak", and distributes publicity materials such as posters and pamphlets to the public either by itself or through relevant departments and district organisations. Roving exhibitions are staged at FEHD's Health Education Exhibition and Resource Centre and the shopping malls of housing estates (see **Figures 14 and 15**), and outreach talks are organised for the management personnel of schools and estates.

Figure 14 and Figure 15: Roving exhibitions on mosquito control (Source: FEHD)





4.30 On its website, FEHD provides advice on proper control actions to be taken by members of the public and management personnel of different venues/premises when the Gravidtrap Index is recorded at different levels, and tips for prevention and elimination of adult mosquitoes/larvae. FEHD also provides specialised anti-mosquito information for different types of premises (e.g. housing estates, construction sites, schools, hospitals, etc.), including measures for dengue prevention and mosquito control.

HANDLING MOSQUITO-RELATED COMPLAINTS

4.31 Upon receiving public complaints about mosquito problems, FEHD would assign the case to the respective PCTs based on the location under complaint. The responsible in-house or contractor staff would obtain further details from the complainant and conduct investigation. For instance, where the complaint involves a multi-storey building premises, investigation would be conducted within an area of 100 to 400 metres of the premises, including inspection of open areas such as roof, light wells, rear lanes, gullies/gully traps and balconies, as well as the premises adjacent to, above and below the premises concerned. Where an outdoor spot is involved, FEHD would patrol and inspect places prone to proliferate mosquitoes, such as tree holes, bamboo stumps, leaf axils, discarded tyres/cans and rubbish piles. If mosquito problems and potential breeding sites are identified, FEHD will take control actions, including proper covering of water storage cisterns, thorough inspection of manholes and gully traps with larviciding to prevent accumulation of water and entry of mosquitoes, and where necessary, application of adulticides.

Mosquito-related Complaint Data

Table 16: Statistics on mosquito-related complaints received by FEHD between 2016 and 2020

	2016	2017	2018	2019	2020
Total no. of complaints	10,162	7,471	9,750	6,812	5,425
Top five districts with highest no. of complaints **(No. of complaints)**	Yuen Long (1,174) Central & Western (795) Islands (762) Kowloon City (734) Tai Po/ Sha Tin (680)	Yuen Long (960) Sham Shui Po (580) Sai Kung (572) Tai Po (565) North (506)	Yuen Long (1,382) Sai Kung (805) Islands (749) Kowloon City (611) Central & Western (605)	Yuen Long (798) Sai Kung (688) Tai Po (573) Central & Western (530) North (500)	Yuen Long (686) Sai Kung (527) Tai Po (478) Sha Tin (371) Islands (359)

4.32 In the course of this direct investigation, we have asked FEHD whether any collation and analysis of mosquito-related complaint data were conducted to understand its trends, which districts were subjected to more serious infestation, issues of public concern, etc. According to FEHD, it maintains monthly and annual statistics on mosquito-related complaints received for each of the 19 districts, and compiles and maintains monthly statistics on mosquito-related complaints all over Hong Kong. FEHD indicated that mosquito-related complaints are affected by many factors, including weather, environment and public concerns about the mosquito problems. For example, due to imported cases of Zika virus infections in 2016[24], and a local outbreak of dengue fever in 2018[25], complaints received in those two years were remarkably more than in the preceding year: from around 7,300 cases in 2015 to more than 10,000 cases in 2016, and from around 7,400 cases in 2017 to more than 9,700 cases in 2018 (see **Table 16**). In 2019, following a decline in local dengue infections[26] with no outbreak of other mosquito-borne diseases, the number of mosquito-related complaints was notably lower than in 2018 (see **Table 16**).

4.33 We have selected several districts with higher numbers of mosquito-related complaints, namely Yuen Long, Kowloon City, Central and Western, and Sha Tin (see **Table 16**), and asked FEHD to explain how it had interpreted complaint data to draw up anti-mosquito measures. In response, FEHD explained that given the differences in geographical location, demographic and other local features, the complaint data cannot entirely reflect the condition of mosquito infestation in a particular district.

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24 According to CHP's data, Zika virus infection has been listed as a notifiable infectious disease since February 2016. Two cases were reported in the same year.

25 According to CHP's data, 163 dengue cases were reported in Hong Kong in 2018, of which 29 were local infections.

26 According to CHP's data, 198 dengue cases were reported in Hong Kong in 2019, only one of which was local infection.

5

STRUCTURE AND MANAGEMENT OF PCTS

TEAM STRUCTURE

5.1 The duties of pest control, including mosquito control, in public places throughout the territory are performed by FEHD's PCTs (comprising in-house and contractor staff) under DEHOs' Pest Control Sections. As at December 2020, the Pest Control Sections had a staff of 740, including Health Inspectors, Senior Overseers, Overseers and Senior Foremen stationed in various districts (with 4 to 5 members in each district) to take care of the overall management and operation of PCTs. Among the PCTs' in-house staff, some of them are Foremen tasked with routine inspections and surprise checks on contractor staff. The remaining in-house staff were divided into 93 teams, each comprising 4 to 11 members, including Workmen II led by a Foreman or Ganger. They were deployed to 19 administrative districts in Hong Kong to perform mosquito prevention and control duties. The contractor staff of 2,178 (divided into 363 teams, each with 6 members) were all responsible for mosquito prevention and control, with 48 to 192 members in each district.

5.2 FEHD reviews annually the manpower and work arrangements of the PCTs in all districts. Factors for consideration include the district's topography and population density, building types in the district, trends of surveillance data (including Gravidtrap Index and Density Index), cases of mosquito-borne diseases (in particular local infections), mosquito-related complaint data, the number of fenced-off vacant sites and construction sites in the district, etc.

5.3 Within the regime of PCTs, the scope of routine duties discharged by FEHD's in-house staff and contractors for mosquito prevention and control is more or less the same, including surveillance under the DVS Programme, patrol of potential breeding sites (such as common parts of buildings, vacant construction sites, slopes and streams) and immediate removal of stagnant water and any discarded objects or containers that may proliferate mosquitoes (such as empty cans, plastic bags and tyres), pruning of

overgrown and wild vegetation, levelling of uneven levees with rocks and soil where necessary and training of streams to eliminate mosquito breeding sources, and proper larviciding and spraying of adulticides.

TEAM MANAGEMENT

5.4 FEHD supervises the performance of PCTs according to its Operational Manual for Pest Control Services and Operational Manual for Management of Pest Control Contracts (referred to as "OMs"). The OM for Pest Control Services is used formanaging and supervising the pest control duties performed by both in-house and contractor staff; the OM for Management of Pest Control Contracts focuses on contract management with guidelines for FEHD staff to oversee contractors.

Contractors' Teams

5.5 Specifically, FEHD draws up monthly work plans for contractors' roving teams based on the actual situation of different districts, including topography, population density, the latest readings of Gravidtrap Index, reports of vector-borne diseases (in particular localinfections) and mosquito-related complaint data. In accordance with the requirements of the approved work plans, contractors have to submit the "Weekly Work Plan of the Contractor" one week in advance before providing services, listing the locations to be served by their teams during different time slots for each day. Contractors are subject to routine inspection by FEHD's Foremen responsible for management of pest control contracts. Each Foreman would select at least one contractor's team for daily field inspection, which includes verifying the attendance/identity of contractor staff, confirming whether services are completed as scheduled in the work plan, checking whether pesticides of the approved types are applied in appropriate ways, and whether the tools and equipment used by the contractor meet the contract requirements, etc. Each Foreman is required to inspect all contractor's teams under his charge for at least two rounds every week, and submit daily inspection reports through FEHD's Contract Management Computer System ("CMS")[27] every day. Contractors are also required to submit daily returns to FEHD on each working day, with such basic information as the number of staff on duty, their posts and hours of attendance, and a daily report on the services performed.

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[27] In the past, Foremen were required to submit service inspection reports in paper form after completing the inspections. In March 2020, FEHD revamped the CMS and revised the content and format of the service inspection report. Currently, Foremen can complete and upload service inspection reports on the CMS using their personal digital assistants.

5.6 Surprise checks at least once per month are conducted by FEHD's Overseers on all contractor's teams under the charge of their subordinate Foremen. Health Inspectors and Senior Health Inspectors should conduct surprise checks, at least once every two months and every four months respectively, on all contractor's teams under the charge of their subordinate Foremen. Moreover, district-wide surprise inspections are conducted quarterly by DEHOs on a pre-determined date to review the performance of all contractor's teams.

5.7 If a contractor's performance fails to meet the contract requirements, FEHD will impose penalties, including verbal or written warnings and default notices with deduction of monthly service fees, based on the gravity of the irregularities. The default records will adversely affect the contractors concerned in their future tenders for FEHD's outsourced service contracts.

5.8 During our direct investigation, we have requested FEHD to provide inspection records of three survey areas (namely Wong Tai Sin Central, Tuen Mun West and Ma On Shan) for scrutiny, covering the following periods: routine inspections in four weeks between 7 January and 3 February 2019 (see **Table 17**), surprise checks in January to April 2019 (see **Table 18**), and district-wide inspections in January to June 2019 (see **Table 19**).

Table 17: Routine inspection records of Wong Tai Sin Central, Tuen Mun West and Ma On Shan between 7 January and 3 February 2019 (Contractors' teams)

Officer rank (No. of inspecting officers in each survey area)	Inspection guidelines (Para. 5.5)	No. of inspections		
		Wong Tai Sin Central (5 teams)	Tuen Mun West (7 teams)	Ma On Shan (3 teams)
Foreman (Wong Tai Sin Central: 5) (Tuen Mun West: 3) (Ma On Shan: 3)	Each Foreman to select at least one contractor's team for daily inspection, and complete two rounds of inspection on all the contractor's teams under his charge every week[28]	40	68	28

Table 18: Surprise inspection records of Wong Tai Sin Central, Tuen Mun West and Ma On Shan in January to April 2019 (Contractors' teams)

Officer rank (No. of inspecting officers in each survey area)	Inspection guidelines (Para. 5.6)	No. of inspections		
		Wong Tai Sin Central (5 teams)	Tuen Mun West (7 teams*)	Ma On Shan (3 teams)
Overseer (1)	Surprise checks at least once a month on all contractor's teams under the charge of subordinate Foremen	Jan: 7 Feb: 6 Mar: 7 Apr: 8	Jan: 7 Feb: 0 Mar: 7 Apr: 6	Jan: 3 Feb: 3 Mar: 3 Apr: 3

[28] According to the inspection guidelines, at least 40 inspections should be conducted on the contractor's teams in Wong Tai Sin Central (5 teams x 2 inspections per week x 4 weeks); 56 in Tuen Mun West (7 teams x 2 inspections per week x 4 weeks); and 24 in Ma On Shan (3 teams x 2 inspections per week x 4 weeks).

Health Inspector (1)	Surprise checks at least once every two months on all contractor's teams under the charge of subordinate Foremen	Jan: 3 Feb: 7 Mar: 10 Apr: 4	Jan: 4 Feb: 4 Mar: 1 Apr: 5	Jan: 0 Feb: 0 Mar: 0 Apr: 0
Senior Health Inspector (1)	Surprise checks at least once every four months on all contractor's teams under the charge of subordinate Foremen	Jan: 0 Feb: 0 Mar: 3 Apr: 2	Jan: 3 Feb: 4 Mar: 1 Apr: 2	Jan: 0 Feb: 1 Mar: 0 Apr: 2

* In April 2019, the number of contractor's teams in Tuen Mun West was reduced to six.

Table 19: District-wide surprise inspection records of Wong Tai Sin Central, Tuen Mun West and Ma On Shan in January to June 2019 (Contractors' teams)

Inspection guidelines (Para. 5.6)	**No. of inspections (Month of inspection)**		
	Wong Tai Sin Central (in Wong Tai Sin District)	Tuen Mun West (in Tuen Mun District)	Ma On Shan (in Sha Tin District)
DEHOs to conduct district-wide surprise inspections quarterly	2 (Feb, Jun)	2 (Mar, Jun)	2 (Feb, May)

5.9 Regarding the routine inspections in **Table 17**, FEHD indicated that some of the records were incomplete (involving Wong Tai Sin Central and Ma On Shan). Regarding the surprise checks in **Table 18**, FEHD admitted that officers of certain ranks (including Overseer and Health Inspector) had failed to fully comply with the requirements for inspection in the survey areas concerned (see **cells filled with colour in Table 18**). FEHD explained that the inadequacies were caused by certain officers' failure to carry out inspections as required, or to input the records on the CMS after inspections. FEHD has duly advised the relevant officers that they should carry out inspections and submit inspection records in compliance with the OMs..

In-house Teams

5.10 Similarly, FEHD draws up monthly and daily work plans for its in-house teams according to the factors in **paragraph 5.5**. In-house teams are required to perform duties as scheduled in the daily work plan. The Foreman or Ganger in charge should submit daily reports together with the necessary inspection forms within two working days. Surprise checks are conducted by Senior Overseers and Senior Health Inspectors, once every two months and every four months respectively, on all their subordinate in-house teams in the district. We have scrutinised the surprise inspection records of Ma On Shan in January to April 2019 (no in-house teams in Wong Tai Sin Central and Tuen Mun West, as pest control services were solely provided by contractors' teams in those two survey areas). Details are given below (see **Table 20**):

Table 20: Surprise inspection records of Ma On Shan in January to April 2019 (In-house team)

Officer rank (No. of inspecting officer in each survey area)	**Inspection guidelines (Para. 5.6)**	**No. of Inspections**
		Ma On Shan (1 in-house team)
Senior Overseer (1)	Surprise checks once every two months on all subordinate in-house teams	Jan: 1 Feb: 1 Mar: 0 Apr: 2
Senior Health Inspector (1)	Surprise checks once every four months on all subordinate in-house teams	Jan: 0 Feb: 0 Mar: 0 Apr: 1

5.11 On the other hand, after examining the OMs, we noticed that some paragraphs use different wordings to stipulate the inspection frequency. Details are given below (see **Table 21**):

Table 21: Comparison between paragraphs in the OMs regarding inspection frequency

<table>
<tr><th rowspan="2">Officer rank</th><th colspan="2">Inspection frequency</th></tr>
<tr><th>OM for Pest Control Services (Part I(A))</th><th>OM for Management of Pest Control Contracts (Part III)</th></tr>
<tr><td>Foreman</td><td><u>Paragraph 5.2(1)</u>:

FM(PC-CM) should conduct inspections to the contractor’s roving teams under his charge at different hours. Surprise inspections must be conducted as the contractors’ roving teams may be familiar with districts’ inspection pattern and schedule.

<u>Paragraph 5.2(2)</u>:

Furthermore, FM(PC-CM) should conduct a surprise check at odd hours (say within one hour after the beginning or before the end of the working hours) to each contractor’s roving team under his charge at least once per month.</td><td><u>Paragraph 7.3.1(iv)</u>:

Guidelines on specific requirements such as minimum inspection frequency and supervisory checks on inspection reports are set out below for observance –

(a) Each Fm(PC-CM)/Fm(MP) should, unless with special permission from SHI, inspect at least one pest control roving team under his charge per day;

(b) Inspections should be conducted on surprise basis….;

(c) On top of the surprise inspections, Fm(PC-CM)/ Fm(MP) should inspect all problematic spots or high risk areas at least once every week as assigned by SHI;

(d) …;

(e) …;

(f) All pest control roving teams should be inspected at least twice a week….</td></tr>
<tr><td>Senior Health Inspector</td><td><u>Paragraph 5.2(7)</u>:

SHI(Cl/PC) should conduct surprise checks on all in-house teams as well as contractor’s roving teams once every four</td><td><u>Paragraph 7.7(v)</u>:

In addition, SHI should in consultation with CHI(1)/CHI organise surprise checks on ad hoc basis –</td></tr>
</table>

	months.	(a) at the beginning and/or the end of the day's work with a view to tightening up the control and monitoring of staff attendance; and (b) on Saturdays, Sundays and public holidays for monitoring the performance of the contractor.

5.12 FEHD explained that the OMs should be read together because they are different in nature with different targets. It also stressed that the OMs' paragraphs on inspection frequency, though not entirely consistent, are not contradictory to each other. To ensure that its staff fully understand the requirements for inspection frequency, FEHD undertook to review the OMs and make necessary amendments.

6

COMMENTS AND RECOMMENDATIONS

OUR COMMENTS

6.1 FEHD plays a leading role in anti-mosquito work. It is responsible for mosquito prevention and control in public places throughout the territory, as well as providing technical support and training for other Government departments in charge of various public venues and premises. Its duties are multi-faceted, including surveillance of *Aedes albopictus* infestation and initiating strategic actions in response to surveillance data, taking preventive and control measures, conducting territory-wide anti-mosquito campaigns and thematic operations, handling public complaints about mosquito nuisance, and managing the PCTs. After examining FEHD's anti-mosquito work, our comments are as follows.

Surveillance Programme

6.2 FEHD's key objective is to prevent and control mosquito vectors. To this end, it has conducted territory-wide surveillance to monitor the prevalence of *Aedes albopictus*, a species with more extensive distribution and a higher risk of transmitting dengue. FEHD's DVS Programme, including its methodology, the apparatus used for surveillance and selected locations, is devised according to the WHO's recommendations, the behaviour of *Aedes albopictus* and Hong Kong's living environment (see **paras. 2.6 and 2.7**). Places with high population density across the territory are covered (see **para. 2.7**), and the surveillance process and index compilation are systematic (see **paras. 2.9, 2.15, 2.17, 2.18 and 2.19**). Moreover, FEHD has reviewed and updated, in a timely manner, the number of survey/port areas, the apparatus used for surveillance, and the categories of surveillance indices (see **paras. 2.21, 2.22, 2.24 and 2.26**).

6.3 Overall, the DVS Programme is effective in monitoring the vector of dengue viruses. Nevertheless, there is room for improvement as to FEHD's release of

information about the DVS Programme, including data analysis and dissemination methods, the meaning of the Density Index, and details of the response mechanism.

Analysis and release of information

6.4 Currently, FEHD releases the Gravidtrap Index (formerly Ovitrap Index) and the Density Index of all survey/port areas every month (see **paras. 3.2 and 3.3**) to inform the public of the prevalence of *Aedes albopictus* at different locations. The two categories of index for all survey/port areas are released monthly by means of table and graphic map (see **paras. 3.3 and 3.4, Figures 8 and 9**).

6.5 FEHD has classified the Gravidtrap Index into different levels and provided a descriptor for each level (see **paras. 2.10, 2.23 and Table 1**). When the index surges to the alert levels, i.e. Levels 3 and 4, FEHD should alert the public. However, FEHD only provides the index monthly in actual figures (see **para. 3.4 and Figure 8**) without mentioning their respective levels and implications. We consider the information released by FEHD unable to alert the public in a succinct manner.

6.6 From the websites of other Government departments, we notice that certain warning signals or indices with classification are adopted to facilitate the surveillance of matters under the departments' purview and release of concise information to the public. Examples are the tropical cyclone warning signals, rainstorm warning signals and ultraviolet index adopted by the Hong Kong Observatory, and the air quality health index used by EPD. When issuing a warning signal or index, the departments would also announce its corresponding level[29].

6.7 Regarding the surveillance indices, we believe that the public is more concerned about the condition of mosquito infestation represented by the indices than the actual figures. As the Gravidtrap Index is classified into different levels, FEHD should have announced the index and its corresponding level, such as Level 1 for an index below 5%, Level 2 for one between 5% and 20%, etc. Based on the descriptor for each level, the public can better understand the severity of mosquito infestation in different survey areas and the proper anti-mosquito measures to be taken (see **para. 4.30**). When the AGIs of some survey areas surge to the alert levels, FEHD should also highlight such survey areas of special concern for better warning effect.

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[29] The tropical cyclone warning signals consist of Nos. 1, 3, 8, 9 and 10. The rainstorm warning signals have three levels, namely amber, red and black. The ultraviolet index is classified into five levels, namely low, moderate, high, very high and extreme. The air quality health index is also classified into five levels, namely low, moderate, high, very high and serious.

6.8 Moreover, there are 64 survey areas at present (see **para. 2.24**). The public might be uncertain about the coverage of each survey area (see **para. 3.4 and Figure 9**). FEHD should delineate the boundaries of the 64 survey areas and release data, including the index and its level, with the assistance of diagrams and interactive maps to make all critical information clear at a glance.

6.9 According to FEHD's data, there was a slightly upward trend in the overall extensiveness of *Aedes albopictus* between 2016 and 2020, although the index remained at relatively low levels (see **para. 2.27 and Figure 6**). Such analysis was based on the percentage of *Aedes*-positive ovitraps/gravidtraps against the total number of traps retrieved annually, which was calculated using the same concept as the MOI/MGI. FEHD also highlights the MOI/MGI to explain to the public monthly whether the threats posed by *Aedes albopictus* are serious, and the MOIs/MGIs over multiple years are compared to reveal the trends (see **para. 2.29 and Figure 7**).

6.10 The MOI/MGI, obtained by aggregating data from all survey areas, can theoretically reflect the territory-wide breeding of *Aedes albopictus* in that month. Nevertheless, there are as many as 64 survey areas. Even within the same month, the indices in different areas may vary substantially. Taking the data from 2016 to 2020 as an example, despite no significant fluctuation of the MOIs/MGIs during this period, there was a rising trend in the number and frequency of survey areas recording an AOI/AGI at Level 3 to Level 4 each month (see **para. 2.28 and Table 5**).

6.11 As such, the MOI/MGI is too broad-brush in reflecting the extensiveness of *Aedes albopictus* in Hong Kong. The more infested areas are often averaged out by those less infested ones causing the public to under-estimate mosquito infestation. Insofar as realistically revealing the overall condition of mosquito infestation of a particular month is concerned, and for the purpose of yearly and multi-year comparisons, the MOI/MGI is seemingly too general without in-depth analysis.

6.12 Therefore, FEHD should review how to optimise the use of data from the DVS Programme, such as conducting a thorough trend analysis of the number of survey areas recording different levels of the AGI monthly, especially Levels 3 and 4. This is to ensure that the results obtained can more accurately reflect the actual condition of mosquito infestation in Hong Kong, and to enhance the breadth and depth of such analysis. As an example, we have compared the number of survey areas recording different levels of the AOI/AGI monthly in 2020 (see **para 2.30 and Table 6**) and the result reveals more serious infestation between May and September. Although the

overall index remained low at Level 2, the situation was worth attention as a number of survey areas recorded an index at Level 3.

Launch of Density Index

6.13 FEHD launched the Density Index in April 2020. It explained that the Density Index enumerates the average number of *Aedes albopictus* mosquitoes collected by each *Aedes*-positive gravidtrap (see **para. 2.26**). A higher index represents more mosquitoes found in each gravidtrap, and hence higher level of *Aedes albopictus* activity.

6.14 The Gravidtrap Index is for evaluating the extensiveness of *Aedes albopictus* in a survey area, and the Density Index is for quantifying the level of *Aedes albopictus* activity. The two surveillance indices are directly corelated in reflecting mosquito infestation. For instance, when both indices are at high levels, it shows that *Aedes albopictus* is extensively distributed in the survey area, and its quantity is also high. When the Gravidtrap Index is low but the Density Index is relatively high, it means that *Aedes albopictus* is not extensively distributed but is relatively active in the vicinity of specific gravidtraps. FEHD has introduced the Density Index with good intention as it allows another perspective for the public to understand the infestation of *Aedes albopictus* in Hong Kong.

6.15 However, the Density Index has been launched and released monthly without proper explanations to facilitate the public's comprehension of its objective, concept and correlation with the Gravidtrap Index. FEHD's approach was not well-considered and might cause confusion to the public.

6.16 Before releasing the Density Index, FEHD should have first classified it into different levels with a descriptor for each level, and considered how to explain to the public the severity of mosquito infestation as represented by the index. Launching the Density Index without classification might cause the public to confound it with the Gravidtrap Index, and undermine the Density Index as an indicator of the activity level of *Aedes albopictus*. As the Density Index has already been introduced, FEHD should avoid causing misunderstanding by specifying that the Density Index now in force is for reference only, and more time is needed for collection and analysis of data to understand the range of the index (see **para. 2.26**). Meanwhile, FEHD should promptly classify the Density Index into different levels with a descriptor provided for each level which should be consistent with the Gravidtrap Index to make sure that the surveillance data

released is more explicit, uniform and comprehensible.

<u>Response mechanism</u>

6.17 Where a survey area records an AGI at alarm levels (i.e. Level 3 or 4), FEHD would activate the response mechanism (see **para. 3.7**) to convene district anti-mosquito task force meetings with Government departments and organisations, property management agents and private venues in the area concerned. The management offices of residential premises, schools, construction sites and public utilities affected would also be notified (see **para. 3.8**).

6.18 FEHD is mainly responsible for the anti-mosquito work in public places (see **para. 1.1**). Hence, when more serious mosquito infestation is detected in certain survey areas, FEHD needs to promptly collaborate with other departments and parties managing venues and premises in those areas to bring the index down to the target level rapidly. We consider FEHD to have acted positively and commendably in establishing the response mechanism, which would not only expedite communication and liaison, but also create synergy for the overall anti-mosquito work.

6.19 We note that FEHD did mention the response mechanism in its press releases but mainly in the months when the mechanism was activated, and that its details were lacking. FEHD had not publicly promoted and disseminated details of the response mechanism through other channels as well.

6.20 Anti-mosquito work is not just the purview of FEHD. It is crucial for other relevant departments, stakeholders and members of the public to do their part to achieve satisfactory results. Moreover, the purpose of establishing the response mechanism is mainly for stepping up communication and liaison amongst stakeholders to enhance the effectiveness of anti-mosquito work. If the public are well informed of the mechanism's details, they can assist FEHD in monitoring and facilitating its actual operation. Besides, if serious mosquito infestation persists in a survey area even after activation of the response mechanism, the public can report the situation direct to the relevant departments or management authorities for follow-up action. We urge FEHD to strengthen publicity of the response mechanism with its details more widely disseminated for greater public awareness and participation, thereby enhancing the effectiveness of anti-mosquito work.

Anti-mosquito Work

6.21 In addition to the territory-wide surveillance of *Aedes albopictus*, FEHD also conducts surveillance of *Culex tritaeniorhynchus* (vector of JE) and *Anopheles* (vector of malaria), which are less extensive and pose a lower risk of disease transmission, at selected locations. Its surveillance includes collecting samples of adult mosquitoes for laboratory tests to assess the risk of disease transmission (see **paras. 2.4 and 2.5**).

6.22 Whether territory-wide surveillance of all mosquito vectors is necessary and which surveillance methodologies are proper for different species are matters relating to FEHD's professional judgement based on its knowledge of various mosquito species and their behaviour, and assessment of their risks. These matters are not subject to our comment. Nevertheless, since FEHD has adopted the current surveillance models for years, it is worth reviewing whether they are still entirely applicable to the present environment and situation. FEHD should devise a mechanism for regularly reviewing its methodologies, including any need to step up surveillance efforts, change or adjust the surveillance process, and include more species in its surveillance. In conducting the review, FEHD may consider inviting local academic institutes to participate in joint research for obtaining expert advice from different sectors. The research results can be used to improve FEHD's strategies and implementation of anti-mosquito work.

6.23 Meanwhile, FEHD mainly uses the integrated pest management approach to carry out routine anti-mosquito work (see **para. 4.5**). Its officers would exchange pest control experience with overseas counterparts and obtain latest information at international conferences and seminars (see **para. 4.13 and Appendix 5**). In recent years, FEHD has introduced new equipment for mosquito control such as the new trapping device and the large-scale ULV fogger (see **paras. 4.13 and 4.15**) to enhance effectiveness. Besides, as shown by the enforcement statistics in **Table 11**, FEHD has taken actions pursuant to the PHMSO against persons responsible for the premises which caused or were likely to cause mosquito breeding.

6.24 We believe that the experience and information obtained from exchange programmes and the new equipment are conducive to enhancing the effectiveness of FEHD's anti-mosquito work. FEHD should keep track of the mosquito control trends and experience overseas, and proactively consider adopting and introducing any methodology or equipment suitable for Hong Kong. It should also step up enforcement to eliminate the source of mosquito breeding.

6.25 We learn that AFCD, HD and LCSD all gave positive responses to FEHD's training and technical support, as well as the territory-wide anti-mosquito campaign and thematic operations (see **paras. 4.19–4.25**). FEHD has also reinforced the surveillance in areas with higher risk of mosquito infestation by establishing a communication mechanism with various departments (see **paras. 4.26–4.28**). We urge FEHD to keep strengthening, based on the existing effective models, the collaboration with other departments to tackle mosquito problems in the community.

6.26 After scrutinising FEHD's pest control records of four survey areas with an AOI at alarm levels, we note that some of the records were only about the daily routines for mosquito prevention and control in those survey areas, with no indication of control actions taken according to the Technical Circular (see **para. 4.9**). FEHD should give proper instructions requiring its staff to clearly record the anti-mosquito actions taken according to the Technical Circular for enhancing internal supervision and monitoring the effectiveness of control actions.

Use of Mosquito-related Complaint Data

6.27 All along, both the vector-borne diseases and the environmental nuisance caused by mosquitoes are of concern to the public. To tackle the problems, FEHD's major target is controlling mosquito vectors (see **paras. 2.4–2.6**) because those species pose a serious threat to public health. As regards the nuisance caused by mosquitoes, FEHD tackles it concurrently with its control of mosquito vectors and handling of public complaints about mosquito infestation (see **para. 2.3**).

6.28 FEHD's information shows that it has in place a mechanism for handling mosquito-related complaints, under which FEHD staff are required to contact the complainants to obtain further details, conduct investigations and perform anti-mosquito work (see **para. 4.31**). FEHD also maintains monthly and annual statistics on mosquito-related complaints received territory-wide and in each district (see **Table 16**).

6.29 Regarding the collation and analysis of mosquito-related complaint data, as well as the trends of caseload and districts subjected to more serious infestation, FEHD explained that mosquito-related complaints are affected by many factors, including weather, environment and public concern about the mosquito problem (see **para. 4.32**). Given the differences in geographical location and demographic features of each district, the complaint data cannot entirely reflect the condition of mosquito infestation in a particular district (see **para. 4.33**). As an example, FEHD cited public concerns about

the mosquito problem as one of the factors, stating that a spike in mosquito-related complaints during 2016 and 2018 coincided with cases of Zika virus infections and an outbreak of dengue fever in Hong Kong (see **para. 4.32**). Nevertheless, FEHD gave no further analysis and explanation on the trends of mosquito-related complaints in the past.

6.30 We acknowledge FEHD's rationale for prioritising the control of mosquito vectors (i.e. *Aedes albopictus*, *Culex tritaeniorhynchus* and *Anopheles*) over the handling of mosquito nuisance. Nevertheless, while targeting the mosquito vectors, FEHD should not neglect the nuisance of mosquitoes caused to the public. As a matter of fact, the more than 70 mosquito species found in Hong Kong are mostly non-vectors causing only a nuisance (see **para. 2.3**).

6.31 Admittedly, non-vector mosquitoes do not pose a serious threat to public health. FEHD also carries out investigations and anti-mosquito work in response to public complaints. However, FEHD has not thoroughly collated and analysed the complaint data, nor has it initiated strategic anti-mosquito measures in districts where mosquito nuisance is more serious. FEHD cannot adequately address public concerns about the mosquito problem and meet public expectations for the authorities' preventive and control work.

6.32 For the general public, the nuisance caused by different mosquito species is indistinguishable. As long as they suffer from frequent mosquito stings in everyday life, they will perceive mosquito infestation as serious. The surveillance data released by FEHD might strike them as falling short of their perception. Hence, FEHD should allocate resources for collation and analysis of mosquito-related complaints to gauge public concerns and identify the districts and locations subjected to higher risk of mosquito infestation, so that it can respond by deploying the manpower and resources of PCTs in a more systematic and efficient manner. In the long run, FEHD should explore the feasibility of incorporating the mosquito-related complaints into its mosquito surveillance data, so as to reflect more comprehensively the actual condition of mosquito infestation in various districts.

Supervision of PCTs

6.33 FEHD supervises the performance of PCTs according to the OM for Pest Control Services (applicable to both in-house staff and contractors) and the OM for Management of Pest Control Contracts (applicable to contractors only) (see **para. 5.4**).

The OMs require FEHD to conduct routine field inspections and surprise checks on the service of contractors. Contractors will be penalised based on the gravity of any irregularity found (see **paras. 5.5–5.7**). Surprise checks on FEHD's in-house teams are also stipulated under the relevant OM (see **para. 5.10**).

6.34 Upon scrutinising the inspection records of three survey areas (namely Wong Tai Sin Central, Tuen Mun West and Ma On Shan), we notice inadequacies in both the routine and surprise inspections on contractors' teams conducted by FEHD's inspection officers of different ranks (including Foremen, Overseers and Health Inspectors). After verification, FEHD explained that they were caused by certain officers' failure to carry out inspections as required, or to input the records on the CMS after completing the inspections. FEHD has given due advice to the relevant officers (see **para. 5.9**). We have to point out that our selection of only a few survey areas for scrutiny has already revealed incomplete/irregular inspection records or insufficient inspections involving officers of different ranks. This reflects not only inadequacies on the part of inspecting officers in discharging their duties, but also the lack of proper supervision over the inspection work by senior management. FEHD should, therefore, consider establishing a mechanism for periodically reviewing whether the inspection requirements under the OMs have been fully complied with, so as to ensure effective monitoring by way of inspection as expected.

6.35 Within the regime of PCTs, the scope of duties discharged by FEHD's in-house staff and contractors is more or less the same (see **para. 5.3**). Adequate supervision over both groups is crucial to ensure proper deployment of manpower. However, we notice that although inspections of FEHD's in-house staff are conducted, they are only subject to surprise checks in every two months and four months (see **para. 5.10 and Table 20**). The frequency is too low and worth a review.

6.36 It has also come to our attention that some requirements for inspection frequency under the two OMs are inconsistent. Taking the inspection by Foremen on contractor staff as an example, the OM for Pest Control Services stipulates the frequency on a monthly basis, while the OM for Management of Pest Control Contracts provides it on a daily or weekly basis. The wordings could lead to misunderstanding (see **para. 5.11 and Table 21**). Noting the inconsistencies, FEHD undertook to review the OMs and make necessary amendments (see **para. 5.12**).

6.37 Based on the analysis in **paragraphs 6.33 to 6.36**, FEHD should comprehensively scrutinise and review the OMs (including introducing a mechanism to

ensure compliance with the inspection requirements, reviewing the frequency of inspections on its in-house teams, and amending those inconsistent paragraphs on inspection frequencies), with a view to enhancing the effectiveness in supervising the PCTs.

OUR RECOMMENDATIONS

6.38 We recommend that FEHD:

<u>DVS Programme</u>

(1) appropriately consolidate the data released monthly under the DVS Programme to make important information clear for better warning effect (see **paras. 6.7 and 6.8**);

(2) review how to optimise the use of the DVS Programme data for more detailed trend analyses so as to depict the actual condition of mosquito infestation in Hong Kong more accurately (see **para. 6.12**);

(3) specify that the Density Index announced is for reference only, and promptly categorise the index into different levels and provide a descriptor for each level, such that the surveillance data will be more explicit, uniform and comprehensible (see **para. 6.16**);

(4) strengthen publicity of the response mechanism activated by surveillance indices to raise public awareness and participation (see **para. 6.20**);

<u>Anti-mosquito work</u>

(5) devise a mechanism for reviewing mosquito surveillance methodologies and seek expert advice from different sectors to improve the strategies and implementation of anti-mosquito work (see **para. 6.22**);

(6) draw up appropriate administrative measures to ensure proper recording of control actions taken in survey areas with the index at alert levels for scrutiny where necessary (see **para. 6.26**);

Use of mosquito-related complaint data

(7) collate and analyse mosquito-related complaints to gauge public concerns and obtain such information as the districts and locations subjected to higher risk of mosquito infestation, so that it can respond by deploying the manpower and resources of PCTs in a more systematic and efficient manner (see **para. 6.32**); and

Supervision of PCTs

(8) comprehensively scrutinise and review the two OMs (i.e. the OM for Pest Control Services and the OM for Management of Pest Control Contracts), with a view to enhancing effectiveness in supervising the PCTs (see **para. 6.37**).

6.39 We are pleased to learn that FEHD is positive towards our recommendations and has started implementation of some of them. We will continue to follow up with the Department until all the recommendations have been fully implemented.

ACKNOWLEDGEMENTS

6.40 The Ombudsman would like to thank FEHD, AFCD, HD and LCSD for their full cooperation in the course of this investigation.

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Appendices

Appendix 1

Ovitrap Indices of a survey area in October 2018
(Surveillance conducted between 12 and 25 October)

Action taken	No. of ovitraps retrieved	No. of *Aedes*-positive ovitraps found on-site	No. of *Aedes*-positive ovitraps after incubation	Ovitrap Index
Day 1 (12 October)				
Setting up 63 ovitraps	-	-	-	-
End of first week's surveillance (19 October)				
No *Aedes* eggs or larvae found after inspecting 61 ovitraps (2 were lost) retrieved from the site Incubation of retrieved ovitraps in laboratory for 1 week Setting up another batch of 63 ovitraps for second week's surveillance	61 (a)	0 (b)	-	First Phase Ovitrap Index (b) / (a) x 100% (0 / 61) x 100% = 0%

End of second week's surveillance (26 October)				
Aedes larvae found in 2 of 61 ovitraps after first week's incubation No *Aedes* eggs or larvae found after inspecting 61 ovitraps (2 were lost) retrieved from the site Incubation of retrieved ovitraps in laboratory for 1 week	61 (d)	0 (e)	2 (f)	<u>Second Phase Ovitrap Index</u> [(b)+(e)+(f) / (a)+(d)] x 100% [(0+0+2)/(61+61)] x 100% = (2/122) x 100% = 1.6%
End of third week (3 November)				
Aedes larvae found in 1 of 61 ovitraps after second week's incubation	-	-	1 (g)	<u>Area Ovitrap Index</u> [(b)+(e)+(f)+(g) / (a)+(d)] x 100% [(0+0+2+1)/(61+61)] x 100% = (3/122) x 100% = 2.5%

Appendix 2

Ovitrap Indices of a port area (belonging to the group of Public Cargo Working Areas) in August 2018

<table>
<tr><th rowspan="2"></th><th rowspan="2">No. of ovitraps retrieved (a)</th><th rowspan="2">No. of Aedes-positive ovitraps found on-site</th><th rowspan="2">No. of Aedes-positive ovitraps after incubation for 1 week</th><th rowspan="2">Cumulative no. of Aedes-positive ovitraps (b)</th><th>Provisional Index</th><th>Monthly Index</th></tr>
<tr><th colspan="2">[(b) / (a)] x 100%</th></tr>
<tr><td>Week 1</td><td>19</td><td>0</td><td>-</td><td>0</td><td>(0/19) x 100% = 0%</td><td rowspan="6">(18/99) x 100% = 18.2%</td></tr>
<tr><td>Week 2</td><td>20</td><td>0</td><td>4</td><td>4</td><td>(4/39) x 100% = 10.3%</td></tr>
<tr><td>Week 3</td><td>20</td><td>0</td><td>1</td><td>5</td><td>(5/59) x 100% = 8.5%</td></tr>
<tr><td>Week 4</td><td>20</td><td>1</td><td>3</td><td>9</td><td>(9/79) x 100% = 11.4%</td></tr>
<tr><td>Week 5</td><td>20</td><td>0</td><td>6</td><td>15</td><td>(15/99) x 100% = 15.2%</td></tr>
<tr><td>Week 6</td><td>-</td><td>-</td><td>3</td><td>18</td><td>-</td></tr>
</table>

Note: FEHD set up 20 ovitraps in this port area.

Port Ovitrap Index for the group of Public Cargo Working Areas (including the port area above) in August 2018

No. of ovitraps set up in the month	**No. of ovitraps retrieved in the month**	**Cumulative no. of *Aedes*-positive ovitraps in the month**	**Port Ovitrap Index**
590	588	35	(35 / 588) x 100% = 6.0%

Port Monthly Ovitrap Index in August 2018

No. of ovitraps set up in the month	**No. of ovitraps retrieved in the month**	**Cumulative no. of *Aedes*-positive ovitraps in the month**	**Port Monthly Ovitrap Index**
6,882	6,877	150	(150 / 6,877) x 100% = 2.2%

Appendix 3

Operating principle of Gravidtrap
(Source: FEHD)

Adult mosquitoes, attracted by the dark, humid environment and the water body inside, enter the gravidtrap to rest or lay eggs.





After flying into the gravidtrap, adult mosquitoes are captured by the glue board.

The gravidtrap has three openings on its lid, allowing mosquitoes to sense the water body inside and fly in.



Appendix 4

List of bureaux/departments/organisations receiving Ovitrap/Gravidtrap Indices and other data from the Food and Environmental Hygiene Department via the Geospatial Information Hub

	Name of bureau/department/organisation
1	Agriculture, Fisheries and Conservation Department
2	Architectural Services Department
3	Buildings Department
4	Civil Engineering and Development Department
5	Correctional Services Department
6	Drainage Services Department
7	Education Bureau
8	Electrical and Mechanical Services Department
9	Environmental Protection Department
10	Government Logistics Department
11	Hospital Authority
12	Department of Health
13	Highways Department
14	Home Affairs Department
15	Housing Department
16	Immigration Department
17	Labour Department
18	Lands Department
19	Leisure and Cultural Services Department
20	Marine Department
21	Social Welfare Department
22	Transport Department
23	Water Supplies Department

Appendix 5

International conferences and exchange programmes participated by the Food and Environmental Hygiene Department between 2014 and 2018

Year	Venue	Name of international conference/ exchange programme
2014	Switzerland	The 8th International Conference on Urban Pests
	United States	PestWorld – National Pest Management Association Annual Conference
2015	Malaysia	Pest Summit of the Federation of Asian and Oceania Pest Managers Associations
	United States	PestWorld – National Pest Management Association Annual Conference
2016	Australia	Pest Summit of the Federation of Asian and Oceania Pest Managers Associations
	United States	PestWorld – National Pest Management Association Annual Conference
	China	World Health Organisation Conference on Prevention and Control of Zika Virus Infections and other Mosquito-borne Diseases
	Macau	Exchange programme with the Macau Health Bureau
2017	Britain	The 9th International Conference on Urban Pests
	Thailand	Pest Summit of the Federation of Asian and Oceania Pest Managers Associations
	Singapore	Exchange programme with the National Environment Agency and the Ministry of Health of Singapore
2018	China	Pest Summit of the Federation of Asian and Oceania Pest Managers Associations